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INTRANASAL EXTENSION OF SELLAR AND PARASELLAR NEOPLASMS.*†

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The anatomical relationship between the sella turcica with its allied structures, the sphenoid sinuses and the nasopharynx, favors their reciprocal involvement by diseases processes. Reference to this concept is to be found chiefly in the writings of pathologists, neurosurgeons and ophthalmologists, with sporadic manifestations of interest in the field of otolaryngology. The aim of this report is to show that the otolaryngologist is directly concerned with lesions which are primarily intracranial and which secondarily involve the nasopharynx or nasal cavities.

Neoplasms of the sellar and parasellar regions included in the essay are the pituitary adenomas and chordomas. Additional tumors to be borne in mind in this connection are those of the hypophyseal duct and its derivatives, together with certain other developmental abnormalities such as teratomas, cholesteatomas and dermoids.

CRANIOPHARYNGIOMA.

The hypophyseal duct tumors in particular deserve mention. They are most commonly referred to as craniopharyngiomas and Cushing's series of 2,000 intracranial tumors included 92 such growths, representing 4.3 per cent of all intracranial

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tumors.[1] A variety of nomenclature is encountered. Embryologically, they are known as Rathke's cysts, craniopharyngeal-duct tumors, craniobuccal pouch tumors and craniopharyngiomas. Histologically, the terms adamantinoma and ameloblastoma are employed. Anatomically, they are designated as suprasellar or interpeduncular cysts.

The clinical manifestations of craniopharyngiomas occur predominantly in childhood or early adult life and are chiefly associated with pituitary dysfunction, intracranial hypertension and compression of the neighborhood nervous structures.[2] A high percentage are said to be demonstrable roentgenographically by virtue of calcification above the sella turcica.[3] Cyst formation, calcium and epithelial masses are the outstanding microscopic features. The prognosis, in general, is poor, although recent reports of surgical results are somewhat more optimistic.[4]

Despite their expected origin anywhere along the course of the embryologic hypophyseal duct, the great majority of these tumors are exclusively intracranial. Furstenberg, however, observed two cases of craniopharyngioma in which the growth presented in the nasopharynx. He was unable to find any similar examples of nasopharyngeal extension in the literature and there have apparently been no additional cases reported since his article was published.[5]

PITUITARY ADENOMA.

Harvey Cushing's early monograph on the pituitary gland called attention to signs and symptoms referable to the nasopharynx.[6] Patients with bleeding and mucus secretion in the pharynx, previously treated for sinusitis, were found to have actual protrusion of tumor tissue in the nasopharynx. It was noted that the lymphoid hyperplasia in dyspituitarism often resulted in adenoid hypertrophy and that adenoidectomy had not infrequently been performed prior to the discovery of the patient's underlying pituitary disorder. Hypophyseal adenomas comprise about 17 per cent of all brain tumors.[1]

Symptoms and Signs: The symptoms and signs of pituitary

tumors are relevant to the clinical aspects of this report. Headache, sellar alterations, primary optic atrophy and bitemporal hemianopsia occur as a result of pressure changes.[7] Eosinophilic or chromophile adenomas, representing 10 to 20 per cent of a large series, are characterized by gigantism (during childhood) or acromegaly (after epiphyseal closure). Chromophobe adenomas are the most common pituitary neoplasms, comprising 80 to 90 per cent of the group. Patients thus afflicted exhibit generalized adiposity, diminution of secondary sexual traits, fatigability, a lowered basal metabolic rate and elevated sugar tolerance. Basophilic adenomas are quite rare and are known to be associated with hypertrichosis, purplish striae, hypertension, impotence, amenorrhea and susceptibility to infection. Mixed types of adenomas may present varied syndromes.[8]

Adenocarcinoma of the pituitary gland is regarded as an extremely rare tumor by most authorities. Others believe that adenomas which extend beyond the sellar limits must be classified as malignant adenomas[8] or adenocarcinomas.[9] The malignant adenomas may produce symptoms and signs quite comparable to those of chromophobe adenomas, while true adenocarcinomas are apt to be more rapidly invasive growths. Ocular palsies and trigeminal nerve involvement may play a considerable rôle in the symptomatology of pituitary adenomas.[10]

Headache, nasal obstruction, postnasal discharge and occasional blood-streaked sputum are among the commonest symptoms encountered by the otolaryngologist. They are also the symptoms presented by patients with extracranial nasopharyngeal extension of pituitary neoplasms.

Pathways and Mechanism of Extension: Estimates of the proportion of unusual expansion of pituitary adenomas range from 14 to 22 per cent in a large series of cases. Jefferson[11] has described extensions of pituitary adenomas beyond their average confines as "taking place in all directions, downwards into the sphenoidal air sinus, outwards towards or into the cavernous sinuses, upwards into the cranial chamber and then by further proliferation either in front of the chiasma into the

anterior fossa, behind it into the third ventricle and hypothalamus, or below it laterally into the middle fossa." White and Warren refer to the downward enlargement into the sphenoid as being the commonest of these pathways.[12] On the other hand, Henderson, in reviewing Dr. Cushing's series of 338 pituitary adenomas, found extension of the tumor through the base of the skull into the nasopharynx in but eight cases, in only three of which it was present at the time of the first hospital admission.[13] In the remaining five cases it did not appear until some years later or was discovered postmortem. He states that the projection of pituitary tumors downwards through the base of the skull is less common than was once generally supposed and that an adenoma which has eroded into the nasopharynx has probably extended upwards sufficiently to produce visual disturbances.

Jefferson considers three main factors in the production of extrasellar extensions: "*a.* the growth urge of the adenoma, *b.* the state of fixation of the chiasma and, *c.* the shape of the pituitary fossa and the nature of its diaphragm." Of these, the most important is the first;[11] however, abnormal fixation of the chiasma may permit extensive growth before sight is impaired. Anatomical variations in the space between the chiasma and the sellar diaphragm, described by Schaefer,[14] may also be significant in this connection. The interclinoid ligaments, rather than the sellar diaphragm, are thought to bear the main thrust of the tumor, accounting for lateral spread towards the cavernous sinuses. Cancellous bone is said by Jefferson to be less resistant than the compact type, so that the tumor spreads more easily downward and backward towards the basisphenoid than forward into the sphenoidal sinuses.

McLean believes that expansion into the sphenoid and nasopharynx is more apt to occur when the sphenoid sinus does not possess a median partition which acts as a basal prop to the sellar floor.[7]

Thus it is apparent that there is some difference of opinion as to the relative frequency of nasopharyngeal extension and the mechanism of spread of these tumors. The basic fact of

nasopharyngeal extension remains and awareness of this possibility is of paramount importance to the otolaryngologist.

Diagnosis: The diagnosis of extrasellar invasion of pituitary tumors into the nasal passages or nasopharynx will depend in a large degree upon the diligence of the rhinologist. A careful study of these regions should include all the available diagnostic aids, including local anesthesia, mirrors, palate retractors, the nasopharyngoscope, digital examination and biopsy studies. The implications of headache, nasal obstruction and blood-streaked postnasal mucus must be borne in mind in this connection. All Roentgenograms of the nasal accessory sinuses should include a lateral view which shows the sphenoid and the region of the sella turcica. Where this is done routinely, sellar abnormalities are discovered once or twice yearly among individuals referred for sinus films because of headache.[15] The importance of microscopic examination of all nasal polyps cannot be overemphasized.

In the differential diagnosis of extrasellar neoplastic extensions one must considered chordomas. These tumors, to be discussed more fully later, may give evidence of sellar enlargement and frequently invade the nasal passages or nasopharynx. They are particularly apt to be confused with malignant adenomas but are less likely to produce pituitary symptoms. The diagnosis will depend upon microscopic study.

Carcinomas arising in the sphenoid sinus or nasopharynx may involve the sella turcica, the pituitary gland and other structures at the base of the brain. The diagnosis of pituitary tumor has been made in instances of sellar invasion by nasopharyngeal carcinoma,[16] although here, as in chordoma, signs of dyspituitarism are usually lacking.[17] Demonstration of squamous, respiratory or transitional types of epithelium in biopsy material point to their true origin and serve to differentiate these growths from malignant adenomas. Though primary nasopharyngeal or sphenoid malignancy as well as malignant adenomas may invade large areas, it is questionable whether actual metastases of the latter tumors have ever been demonstrated.[18] True adenocarcinoma of the pituitary may be

extremely difficult to distinguish from malignancy arising in the paranasal sinuses or nasopharynx. The same may be said of atypical pituitary carcinomas, variously reported as sarcoma, angiosarcoma, myxosarcoma, perithelioma or endothelioma.

Other tumors involving the retropharyngeal area include retropharyngeal sarcoma, osteosarcoma of the basisphenoid and metastatic growths to the middle of the base of the skull.

Meningiomas of the olfactory groove, the sphenoid ridge or the orbit, and certain neurogenic tumors may secondarily involve the nasal structures.[19] Craniopharyngiomas and developmental abnormalities were alluded to previously.

Treatment: No attempt will be made to evaluate the various methods of treatment of pituitary adenomas. Of historical interest, however, is the fact that for many years the transsphenoidal operation was the preferred surgical approach. Originally inaugurated by Schloffer, this technique was modified and extensively practiced by Schmiegelow, Killian, Hirsch, Cushing and others. Although now largely abandoned by neurosurgeons in favor of the transfrontal approach, it still has strong advocates whose successful results and mortality statistics compare favorably with those of the neurosurgeons.[20]

It is recognized that complete removal of pituitary tumors is impossible. Irradiation with Roentgen rays or radium, transfrontal, trans-sphenoidal and paranasal approaches, alone or in combination, all have adherents.[20-23] Henderson recommends the trans-sphenoid operation as the method of choice in patients having a greatly ballooned sella with homonymous hemianopsia or bilateral central scotomata, and also in elderly patients or those with hypertension.[13]

The only available figures regarding the surgical prognosis in the presence of extrasellar spread are given by Jefferson, who states that operation is of doubtful value in most cases with large extensions. In this author's series of 128 pituitary adenomas, there was a 2 per cent mortality for small adenomas and a 33 per cent mortality in those with extensions; the latter group represented 12 cases. It should be mentioned

parenthetically that no cases of nasopharyngeal involvement were cited in his summary.

Henderson believes that nasopharyngeal extensions should be treated by Roentgen therapy, with or without transfrontal evacuation, to relieve chiasmal compression, and that the nasopharyngeal mass should not be disturbed.

Any operative intervention on hypophyseal tumors should be planned with thorough consideration of all possible pathways of extension. Evidence would seem to indicate that invasion of the nasopharynx or nasal passages is a manifestation of clinical, if not microscopic, malignancy, and that the prognosis in these cases is affected accordingly.

REPORT OF CASES.

Case 1: History of amenorrhea for 18 years. Nasal obstruction and impaired hearing; recommended for adenoidectomy and treated as allergic rhinitis. Polyp in left superior meatus proven to be pituitary neoplasm. Regression of tumor and symptoms following Roentgen therapy. Death from massive extrasellar involvement by malignant chromophobe adenoma.

W. R., an unmarried Negress, aged 44, was first seen in a large dispensary in September, 1940. She had sustained a severe head injury at the age of 32 and there had been recurring attacks of convulsions and unconsciousness since that time. During the year preceding admission, these episodes were occurring three times weekly and lasting about five minutes. Some years previously she had been under treatment with thyroid extract and thyrotropic factor because of a low basal metabolism. Her menstrual periods began at the age of 13, became irregular at 25 years and ceased entnrely at the age of 26. Physical examination was noteworthy chiefly because of large pendulous breasts, scanty axillary and pubic hair, some puffiness of the eyelids and diminished hearing. The fundi and visual fields were normal. Basal metabolic readings ranged from —10 to —24. The blood pressure was 130/70.

Thyroid, phenobarbital and anteron were administered without any appreciable change in the convulsive seizures. The patient was referred to the department of otolaryngology in October, 1940, because of nasal obstruction and impaired hearing. Examination revealed evidence of allergic rhinitis with polyps in the left nasal fossa, adenoids, chronic tonsillitis and bilateral secretory otitis media. Tonsillectomy and adenoidectomy were recommended and desensitization therapy was begun. Operation was deferred until the seizures could be studied more fully. Some months later, in May, 1941, another observer detected a diffuse enlargement of the posterior half of the nasal septum and a polyp in the left olfactory sulcus (see Fig. 1). Biopsy of this tissue was interpreted as being of pituitary origin (see Fig. 2). Roentgenograms at this time showed marked destruction of the sella turcica with involvement of the sphenoid sinus (see Fig. 3). The right tympanic membrane presented a bluish hue; there was serous secretion in the left tympanum. Hearing

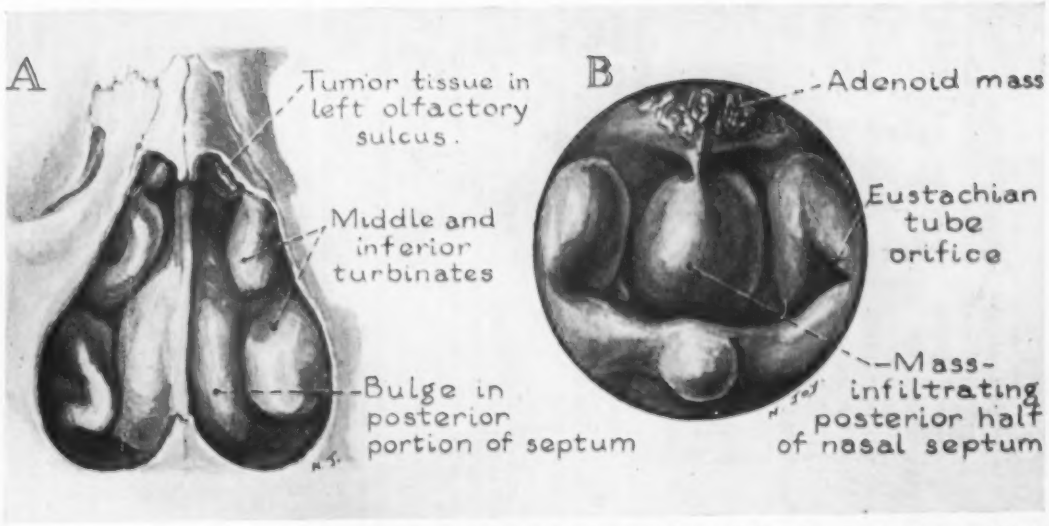

Fig. 1. Case 1. (A) Schematic representation of polyp-like growth in left olfactory sulcus and diffuse swelling of nasal septum, noted on anterior rhinoscopy. (B) Mirror view of nasopharynx. The posterior septal bulge obscured the turbinates but did not obliterate the superior choanal margins. Note the adenoid tissue.

tests were characteristic of bilateral conducton impairment. The visual fields and ocular fundi were again tested and found to be normal.

Roentgen therapy was started in June, 1941. The patient continued to have severe headaches and epileptiform seizures, often injuring herself by falling. In early June, 1941, she complained of a profuse nasal discharge. Clear fluid leaked from the left nasal cavity at the rate of 3 cc. every 15 minutes. Chemical analysis disclosed its glucose content to be 85 mg. per 100 cc., confirming the clinical impression of cerebrospinal rhinorrhea.

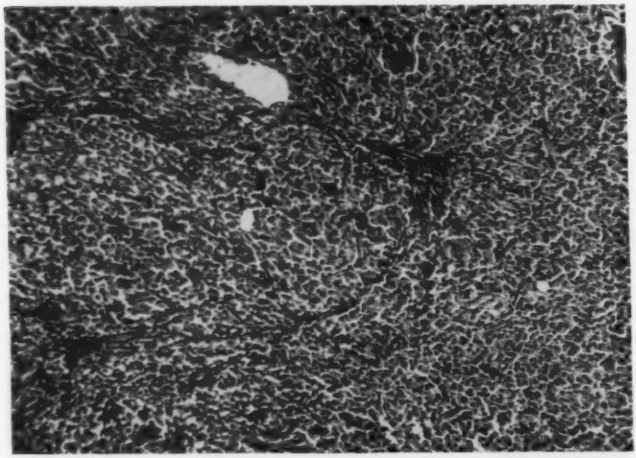

Fig. 2A. Case 1. Photomicrograph of polyp removed from left olfactory sulcus. Note the compact arrangement of small cells in cords and groups. Chromophobe adenoma of the pituitary gland. Hematoxylin and eosin stain (×100).

In the next six months period stilbestrol was administered along with dilantin and anteron. Convulsive seizures became less frequent, the cerebrospinal rhinorrhea ceased and there was marked recession of the intranasal tumor tissue. Menstruation (the first in 18 years) appeared in December, 1941, and lasted four days. A breast abscess developed in late February, 1942, and milk could be expressed from both mammary glands. In May, 1942, one year after the original diagnosis had been made by intranasal examination and biopsy, only a mere bulge in the posterior part of the septum was evident. No tumor tissue could be seen in the olfactory sulcus. Nasal breathing and objective hearing tests had improved greatly. Seizures, however, never disappeared completely, and headaches were usually troublesome.

In June, 1942, the patient was found unconscious in her home and was taken to a city hospital where a cranial decompression operation was performed. No extradural or subdural hematoma was found. The spinal fluid was blood-tinged. The assumption was that there had been hemor-

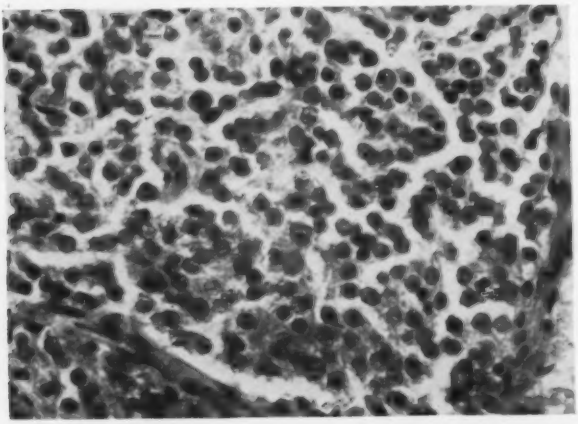

Fig. 2B. Same section under high magnification. Note the cluster-like distribution of cell groups, the indistinct cytoplasm and the prominent nucleoli (×430).

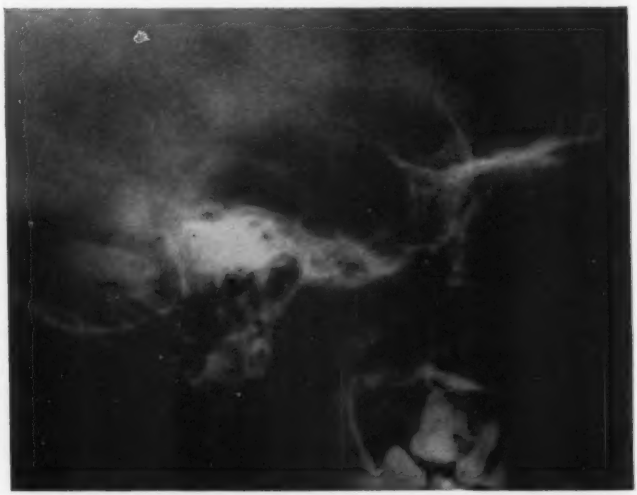

Fig. 3 . Case 1. Roentgenogram showing marked ballooning of the sella turcica. There is destruction of the floor of the sella and the posterior clinoids with some erosion of the anterior clinoid processes.

rhage into an intracranial tumor. The subsequent clinical course did not vary, seizures of unconsciousness, with and without convulsions, occurring several times weekly. Eyegrounds and visual fields were repeatedly normal, the last recording being in March, 1943. Lactation continued throughout 1943. The patient was last seen in January, 1944. Circumstances relating to her death in April, 1944, were not known, but permission for autopsy examination was obtained after the body had been embalmed.

Necropsy: The principal finding was proliferation of a soft bluish-red tissue at the base of the brain, which had superficially invaded the under surfaces of the temporal lobes medially and had pushed upwards against the floor of the third ventricle and optic chiasm. There was further invasion of the bony tissue about the sella turcica with extension inferiorly into the sphenoid sinuses and nasal cavities, laterally on either side of the sella and posteriorly along the basilar portion of the occipital bone as far as the foramen magnum. The pituitary gland was not identified, being entirely replaced by tissue similar to that described. The optic chiasm was intact. There were no evidences of metastases. Congestion, edema and lobular hemorrhages in both lungs were characteristic of a terminal hypostatic aspirational pneumonia. There were no other pertinent findings.

Microscopic examination of the tissue was unsatisfactory for detailed study of cell structure because of postmortem changes; however, one observed small cells, compactly arranged in irregular cords and masses supported by delicate stroma in relation to well-formed vascular channels. The tissue resembled the original biopsy specimen in all respects. There was invasion of the dura but not of the brain substance. The conclusion was that this tumor typified a diffuse invasive pituitary adenoma or the so-called malignant chromophobe adenoma.

COMMENT.

The patient's symptoms of pituitary dysfunction were of 18 years' duration. Although there was a tentative diagnosis of pituitary tumor, this was not definitely established until extracranial extension had resulted. A nasal polyp, erroneously thought to be of allergic nature, proved to be pituitary neoplasm.

Tumor infiltration of the posterior half of the nasal septum was evidently of sufficient degree to cause bilateral secretory otitis media. This patient was almost subjected to adenoidectomy for the relief of nasal obstruction and hearing deficiency.

The development of spontaneous cerebrospinal rhinorrhea is noteworthy because of its infrequent occurrence. In Cushing's series, it was observed but once in nonoperated cases.

The fact that normal visual fields and ocular fundi persisted throughout the period of observation indicated sparing

of the optic chiasm by neoplastic extension. The patient's convulsive seizures, apparently resulting from a severe head injury, became more severe with the intracranial spread of the tumor.

Regression of the intranasal tumor mass, accompanied by objective improvement in nasal and auditory function, indicated a beneficial response to irradiation. In addition, there was cessation of the cerebrospinal rhinorrhea. Necropsy, however, brought out the widespread extrasellar expansion of the growth.

An explanation is lacking for the sudden and rapid activation of a pituitary adenoma after many years of relative dormancy, but this phenomenon is known to occur.

Case 2: Fröhlich syndrome, left exophthalmos, recent nasal obstruction with postnasal mucus discharge and blood-streaked sputum. Roentgenographic evidence of sellar erosion. Normal visual fields and fundi. Presentation of tiny mass at superior margin of right choana proven on biopsy to be chromophobe adenoma. Unsuccessful Roentgen therapy. Transfrontal operation with excavation of sellar contents. Postoperative improvement with inactivity of principal symptoms to present time.

J. L., a white male, aged 24, was first seen in May, 1946. His chief symptom was left frontal headache present intermittently for three years and intensified in the nine months prior to admission. The headaches began at the time of the patient's Army service and were localized above the left eye, with occasional radiation to the left occiput and left upper jaw. They were aggravated by excitement and physical exercise, were not accompanied by any nausea, vomiting, vertigo, blurred vision or spots before the eyes. A diagnosis of migraine was made in the Army in August, 1945. At the time of admission, the headaches were occurring daily but were relieved by mild analgesics.

In addition, the patient had recently noticed that his left eye seemed a bit more prominent than the right. There had been no diplopia. A generalized fatigability had been evident, along with increased nervousness and emotionalism. In the preceding nine months he had become somewhat obese, with a tendency toward feminine distribution of fat on the body. He did not begin to shave until the age of 20 and in the past three years had been accustomed to shave only once or twice weekly. He claimed that his libido was normal, though he had never had any sexual experience.

In the three weeks before admission there had been slight nasal obstruction with an excess of mucus postnasal discharge each morning. This secretion had been consistently streaked with blood. There had been no disturbance of taste or smell, no aphasia or speech difficulty, no alteration of fluid intake or output and no subjective loss of visual acuity.

The patient had enlisted in the Army in 1942 and was discharged in November, 1945, having served two years overseas with a field artillery battalion. The remainder of his past history with regard to family, previous illnesses and occupational status was noncontributory.

Examination: Physical examination revealed all the signs of a mild Fröhlich syndrome, including feminine distribution of fat around the hips, breasts and shoulders, fine silky hair of the scalp, axillae and pubic regions, plus a soft and fairly high-pitched voice. There was slight proptosis of the left eye but the extraocular muscular motility was normal. Visual acuity of 20/20 in each eye was recorded; there was minimal blurring of the nasal margin of each optic disk, the visual fields were within normal limits and there was no enlargement of the blind spots. Further neurological examination was entirely negative. Aside from small genitalia, the general physical examination was negative. Blood pressure was 110/85; urinalysis, blood chemistry and serology were normal. The basal metabolic rate on three occasions was —21, —10 and —17.

Roentgen Observations: Roentgen rays disclosed deepening of the floor of the sella turcica, marked erosion of the posterior clinoid processes, partial erosion of the anterior clinoid processes, no evidence of increased intracranial pressure, and normal optic foramina. There was some lack of clarity of the sphenoid sinuses but no definite erosion of these structures. The findings indicated a space-occupying lesion in the region of the sella turcica (see Fig. 4).

Fig. 4. Case 2. Roentgenogram illustrating moderate enlargement and ballooning of the sella turcica with destruction of the posterior clinoid processes.

At this point in the patient's study, the neurosurgical resident made a tentative diagnosis of pituitary neoplasm, probably of the chromophobe type, which had extended beyond the sellar boundaries to produce a left exophthalmos and, because of the blood-streaked sputum, possible erosion through the sphenoid sinus. The lack of visual disturbance was commented upon. A left perisellar meningioma was also under consideration.

Rhinological Observations: Otolaryngological consultation was requested and the following observations were made: "On examination one observes *a.* an area of recent bleeding on the right side of the nasal septum anteriorly; *b.* bloody postnasal mucoid secretion; *c.* normally patent left nasal fossa; and *d.* a small area of infiltration superiorly at the posterior margin of the nasal septum on the right side (see Fig. 5). This mass is contiguous to the anterior border of the sphenoid, appears as a purplish neoplastic swelling and, in view of the history, should be carefully studied." The above abnormality was first noted on mirror examination of the nasopharynx. The tissue was visualized by anterior rhinoscopy only after thorough shrinkage of the turbinates with cocaine and adrenalin. Nasopharyngoscopic study brought out the color contrast between the infiltration described and the adjacent nasal mucosa. The tissue bled

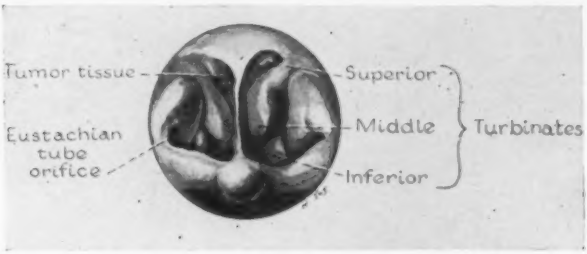

Fig. 5. Case 2. Mirror view of nasopharynx showing tiny projection of tumor tissue at posterior superior septal border on the right side.

readily upon palpation with a cotton-tipped applicator. A biopsy specimen measuring 5 x 4 mm. was obtained. No undue bleeding resulted. Additional ear, nose and throat studies, including audiometric examination, were normal.

Microscopic Study: The pathological report disclosed a tumor of probable primary origin in the anterior portion of the pituitary gland. Columns and sheets of cells were arranged in pituitary fashion. The stroma was well vascularized and delicate. The cells were moderately hyperchromatic and quite uniform. The cytoplasm was uniformly cloudy with no particular stain affinity. Diagnosis: Adenoma, pituitary gland, chromophobe type (see Fig. 6).

Clinical Course: The consultant in neurosurgery, commenting upon the patient's normal visual fields and visual acuity and the fact that the tumor had broken through the floor of the sella and the sphenoid air cells, recommended a course of deep Roentgen therapy with careful observation for any evidence of field defects which might result from irradiation edema.

Accordingly, the patient was given 6,000 Roentgen units to the pitui-

tary gland, divided equally between right and left lateral skull portals. This treatment was begun on July 5, 1946, and completed on Aug. 1, 1946.

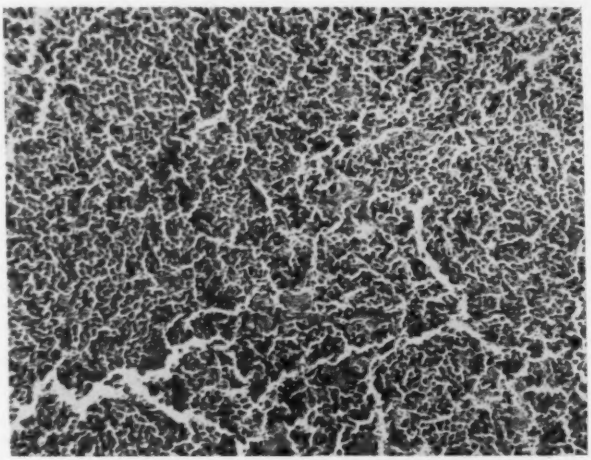

Fig. 6A. Case 2. Photomicrograph of biopsy specimen removed from posterior superior septal border (see Fig. 5). Chromophobe adenoma of the pituitary gland. Hematoxylin and eosin stain (×100).

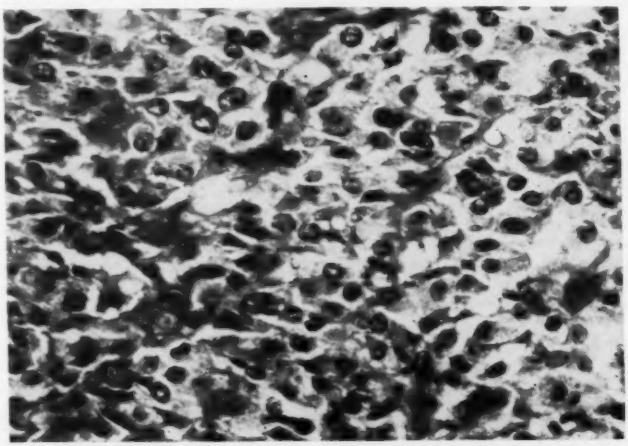

Fig. 6B. same section under high magnification (×430).

No change in the appearance of the small mass on the posterior surface of the nasal septum was noted following Roentgen therapy. The ophthalmological findings remained constant. Headaches diminished in severity and the chief complaint was the persistent prominence of the left eye and some nasal blockage. He was discharged from the hospital on Aug. 14, 1946, and advised to report for re-examination in two months.

On readmission in November, 1946, the patient's symptoms were essentially the same as on his first admission in May of the same year. The left frontal headaches were constant and dull, not as severe as prior to Roentgen therapy, but intensified by stooping or straining. Fatigability and nervousness had persisted, as had the nasal blockage. The physical and neurological and laboratory findings were unchanged. The surface of the nasopharyngeal tumor seemed to be smoother than on previous examinations. Surgical intervention was advised by the consultant in neurosurgery.

Operation: On Nov. 27, 1946, a right frontal osteoplastic craniotomy was performed. A tumor was located between the posterior border of the anterior clinoid and the optic chiasm. It was dark purple in color, enclosed by a firm capsule, and did not extend laterally to cover the optic artery or vein, nor did it project posteriorly. Extension anteriorly and downward into the sphenoid was observed. The contents of the enlarged sellar region and sphenoid sinus were removed with suction. There was no troublesome bleeding. Microscopic examination again disclosed pituitary adenomatous tissue of the chromophobe type. The postoperative course was uneventful except for the development of cerebrospinal rhinorrhea. On Jan. 6, 1947, examination by the otolaryngologist was recorded as follows: "The previously noted tumor mass on the superior mesial border of the right choana is reduced in size to the point where it is not more than a slight bulge in this region, and can be identified only by its altered color. It may still be noted on both anterior and posterior rhinoscopy, but might well be overlooked were not one aware of the previous situation. After holding the head forward for several minutes, watery fluid can be seen in the recess between the middle turbinate and the septum on the right side. . . ."

An attempt was made to treat the cerebrospinal rhinorrhea conservatively without success. On Jan. 29, 1947, the previous operative site was reopened; a large cavity was encountered and previously prepared strips of muscle and fascia were used in generous quantities to completely pack the cavity, which was formerly the sphenoid sinus and the sella turcica. Fibrin foam was used to cover the entire mass, giving a clean, smooth dry roof to present against the under surface of the chiasm.

Present Status: Following this procedure, the patient's rhinorrhea ceased. He left the hospital on Feb. 24, 1947, markedly relieved of all his symptoms. A communication in September, 1947, stated that he felt much better than prior to surgery, although he still lacked energy and tired easily. His left eye was alleged to have receded somewhat, but physical exertion still caused discomfort in this region. Postnasal congestion, present in the mornings only, had been occasionally productive of a few flecks of blood.

COMMENT.

This patient's headaches had been diagnosed as migraine three years prior to admission. Protrusion of the left eye led

to further investigation, resulting in the tentative diagnosis of pituitary neoplasm. By this time the lesion had extended laterally from the sella into the superior orbital fissure. An astute neurosurgical resident considered the possibility of erosion through the sphenoid as an explanation for the nasal obstruction, postnasal discharge and blood-flecked sputum.

Careful rhinological study confirmed this conjecture and the diagnosis of chromophobe pituitary adenoma was definitely established on the basis of intranasal biopsy.

As in Case 1, there were no fundus alterations, visual field defects or disturbances of ocular mobility. It is evident that too much reliance cannot be placed upon ophthalmological abnormalities as a prerequisite for the diagnosis of pituitary neoplasms.

It is entirely possible that sinus Roentgenograms were taken in the Army before the diagnosis of migraine was submitted. One is led to speculate on the subsequent course of events had lateral views of the sphenoid and sella been included in these studies.

The prognosis in this case must of necessity remain dubious because of the known extrasellar invasion of the tumor. While a capsule was found on the superior approach to the growth at operation, the nasopharyngeal and orbital invasions were doubtless extracapsular and it may be assumed that there will be further growth in these locations.

CHORDOMA.

Several complete reviews on the subject of these tumors have appeared in recent years.[24,25] Formerly considered quite rare, it is now apparent that awareness and recognition of the growths are responsible for an increasing number of accurate diagnoses.[26]

Etiology and Incidence: Chordomas are tumors which have their origin in the vestigial remains of the fetal notochord and thus may be found anywhere from the spheno-occipital to the sacrococcygeal regions. Notochordal tissue persists in

the vertebral column as the nucleus pulposus. The tumors encountered by the otolaryngologist are those of the cervical and spheno-occipital group. Faust and his associates assembled all the available data and reported a total of 92 cases of cranial chordomas, which included the spheno-occipital and nasopharyngeal growths.[25] This figure represents approximately 36 per cent of the total number of reported chordomas, the remainder being those found in the sacrococcygeal or vertebral areas. Patients of middle age are most commonly affected.

Pathology: Cranial chordomas usually begin at the junction of sphenoid and occipital bones in the region of the sella turcica. They may protrude into the cranial cavity, into the sphenoid sinus, nasopharynx or orbit, or in all directions. As a rule they are slow-growing but may be responsible for marked deformities. Benign and malignant types have been described and the latter may metastasize. Extensive involvement of adjacent tissues is characteristic of both types.[27]

The histological structure is apt to be extremely variable, depending upon different phases of the growth. There may be a resemblance to hyaline cartilage but without intercellular substance. The cells can be large, vacuolated and hyperchromatic and may simulate epithelium. Extensive mucin formation can be seen both within and between the cells. The presence of these physaliferous or huge vacuolated mucin or glycogen-containing cells is one of the diagnostic features. Portions of the tumor may resemble sarcoma, other portions alveolar carcinoma. Ewing states that positive identification is not readily accomplished, and that the gross relation of the tumor should be given first consideration in the diagnosis.

Symptoms and Signs: In the cranial chordomas, signs and symptoms are apt to be those of a brain tumor or a nasopharyngeal growth, with headache, ocular disturbances, nasal obstruction or discharge, and epistaxis. Nausea, vomiting and vertigo are frequently found. The involvement is most frequently unilateral and may, of course, include one or several of the cranial nerves. Where the growth is principally ante-

rior, obstruction to breathing may result from extension into the nose and nasopharynx.

Roentgenograms may indicate erosion or destruction of the cranial floor or sella turcica. A tumor mass is usually identifiable within the nasal passages, nasopharynx or pharynx. In the latter site, dysphagia or dyspnea may be present.[28]

Diagnosis: The diagnosis may be suspected in any individual of middle age who complains of nasal discharge and obstruction, epistaxis, dysphagia or dyspnea, and who is found on careful examination to have a tumor in the upper passages. Roentgenograms indicating sellar destruction should be followed by biopsy studies. The latter may require special fixation and staining techniques for mucin and glycogen. Aspiration biopsies have been recommended by Boldrey and McNally as an aid to diagnosis.[29]

The differential diagnosis has been mentioned on previous pages and encompasses all lesions of the base of the brain which are capable of nasal or nasopharyngeal extension. In addition, chondromas, chondrosarcomas and myxosarcomas may offer some problems because of their similar cell structure. Vascular fibromas of the nasopharynx usually appear in younger individuals but may expand in a manner not unlike that of chordomas.

Prognosis and Treatment: The prognosis in cases of cranial chordoma with intranasal extension is poor. The extent of the growth at the time of diagnosis usually precludes any possibility of thorough surgical removal. Radium and Roentgen therapy are of no proven value. Local recurrences are common and considerable palliative relief may be obtained by removal of this tissue when accessible by virtue of its extensive intranasal spread. Surgical diathermy is of value in the removal of the tumor and the control of profuse bleeding which accompanies the procedure.

CASE REPORT.

Case 3: Nasal obstruction accompanying loss of vision and protrusion of the right eye. Nasal polypectomy without microscopic examination.

Roentgenographic evidence of destruction of the sella turcica and posterior clinoid processes suggesting pituitary tumor. Biopsy of nasal mass with bizarre microscopic findings but probably indicative of chordoma. Exploratory craniotomy. Palliative removal of recurrent tumor tissue in nose by surgical diathermy on four occasions during past year.

E. L., a 41-year-old white, married female, became aware of blurred vision in her right eye in October, 1944. Following two series of Roentgen ray treatments, her vision returned and she remained well until October, 1945, when the same symptom recurred. The therapy was repeated, without effect. By January, 1946, there was complete loss of vision in the right eye. Protrusion of the eye began in February, 1946, with accompanying pain, loss of sensation in the right infraorbital region and nasal obstruction. She consulted a rhinologist at this time and polyps were removed from the right nasal cavity. No microscopic examination was made of the excised tissue.

Examination: Upon examination in March, 1946, the remote past history was found to be noncontributory. The patient had two grown children and her menstrual periods were normal. There was marked proptosis of the right eye with slight ptosis, paresis of the right external rectus, superior rectus and inferior oblique muscles, along with loss of light perception and optic atrophy. The sense of smell was bilaterally absent and there was complete anesthesia of the right infraorbital and right external nasal regions. The fundus picture and visual fields were normal in the left eye. Roentgen rays of the skull disclosed destruction of the sella turcica with erosion of its floor and the posterior clinoid processes, suggesting pituitary tumor (see Fig. 7). The possibility of a

Fig. 7. Case 3. Roentgenogram showing enlarged sella turcica with erosion of the posterior clinoid processes, destruction of the floor and involvement of the sphenoid sinuses.

meningioma was also mentioned. A provisional diagnosis of sphenoid ridge meningioma was advanced by the attending neurosurgeon.

Rhinological Observations: Intranasal examination disclosed a firm, pinkish-gray tumor mass presenting in the right nasal fossa and in the nasopharynx. This tissue grew downward from the olfactory sulcus to occupy and enlarge the space between the right middle turbinate and the septum (see Fig. 8). It was quite immobile. On the left side, one

Fig. 8. Case 3. Schematic representation of intranasal tumor mass growing between middle turbinate and nasal septum on the right side.

had the impression that the neoplasm was growing into the septum, the borders being not so clearly demarcated as on the opposite side. The right maxillary sinus did not transmit light. Removal of a biopsy specimen was followed by rather profuse bleeding. The possibilities of a sphenoid malignancy and chordoma were described at the time of this consultation.

The pathological report on the nasal biopsy described a tumor composed of large, elongated cells with occasional large vacuoles, bearing a certain resemblance to hypernephroma. The diagnosis was "malignant tumor of undetermined type in the region of nasopharynx and orbit" (see Figs. 9, 10 and 11).

Operation: An exploratory craniotomy was performed on March 26, 1946, through a frontal approach to the pituitary body. The right optic

nerve was found to be flattened by a beefy, reddish, firm mass which seemed to be extradural and pressing back from the orbit. The roof of the orbit was thin and was removed from its lateral margin to the

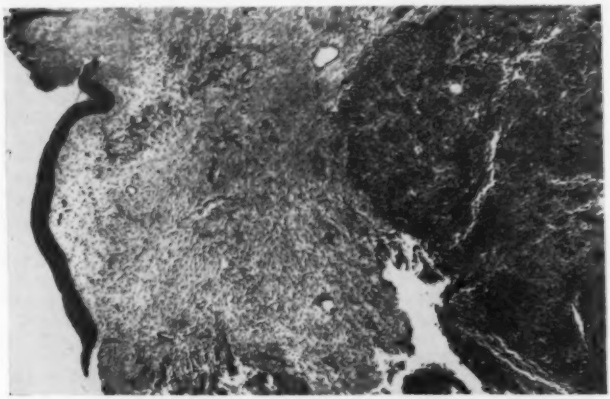

Fig. 9. Case 3. Photomicrograph of biopsy of tumor mass (see Fig. 8). Note the advancing border of neoplastic tissue in the subepithelial layer. Hematoxylin and eosin stain (×32).

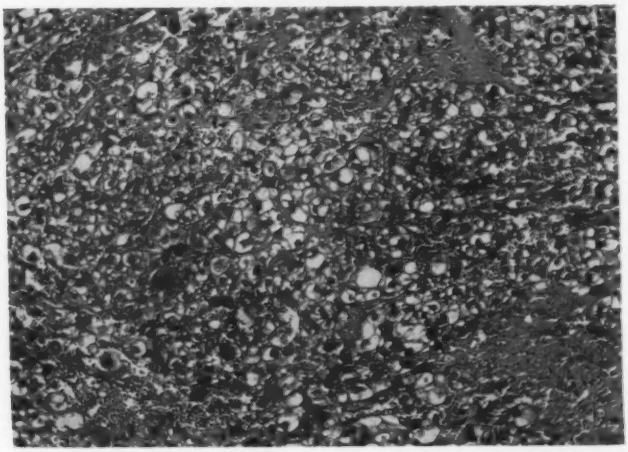

Fig. 10. Case 3. Photomicrograph of tumor tissue seen in Fig. 9, higher magnification. Note the large cells with extensive vacuolization of the cytoplasm. Chordoma. (×100.)

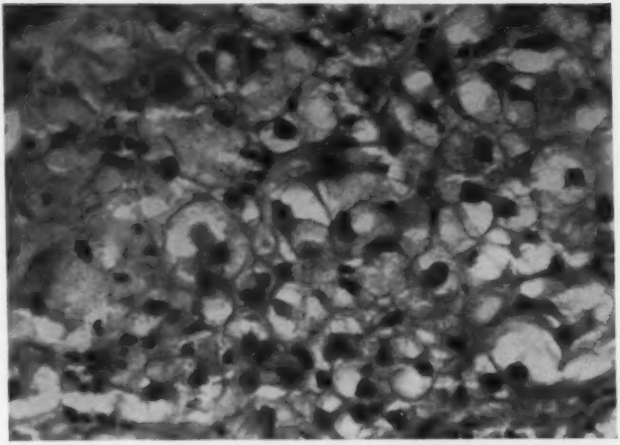

Fig. 11. Case 3. Photomicrograph illustrating detailed structure of physaliferous cells with intercellular and intracellular mucin. Alum-hematoxylin stain (×430).

olfactory plate, including the optic foramen. Tissue was removed for section from along the olfactory groove. Twenty radon seeds were placed in the medial aspect of the orbit into tumor tissue and the bone flap was replaced.

The next pathological report indicated further doubt as to the tumor's classification (see Fig. 12). Meanwhile, another observer had viewed the sections and expressed the opinion that the tumor was a chordoma.

Subsequent Course: The patient remained fairly comfortable following surgery until Noveember, 1946, when she began to complain of nasal obstruction and bleeding from the right nostril. Tumor tissue presented in the right nasal vestibule. As a palliative measure it was decided to implant radon seeds in this mass. When surgical diathermy with a cutting loop was successfully used to remove the anterior portion of the growth, it was decided to continue the excision. Despite rather profuse bleeding, the tumor content of the right nasal cavity was removed posteriorly to the sphenoid and superiorly to the cribriform plate. In February, 1947, there was evidence of tumor tissue superiorly in the right nostril, but the airway remained adequate and the patient continued to perform her household duties. In March, 1947, the intranasal mass was again thoroughly removed with coagulation diathermy. The rostrum of the sphenoid and the posterior portion of the nasal septum had been destroyed by tumor and the right ethmoid labyrinth was extensively infiltrated.

Following this operation, the tumor seemed to grow much more rapidly than previously and completely refilled the nasal passages within a few weeks. A trigeminal rhizotomy was performed in May for the relief of pain. By June, 1947, tumor tissue was protruding from the right naris

and was again removed. Each of the intranasal procedures was carried out using local anesthesia. Though bleeding was active, it was controllable with diathermy and packing. In October, 1947, the patient's condition was poor and she was not expected to survive.

COMMENT.

The patient's nasal obstruction was accompanied by loss of vision and some protrusion of the eye. Despite this, nasal polyps were removed and not studied histologically, thus

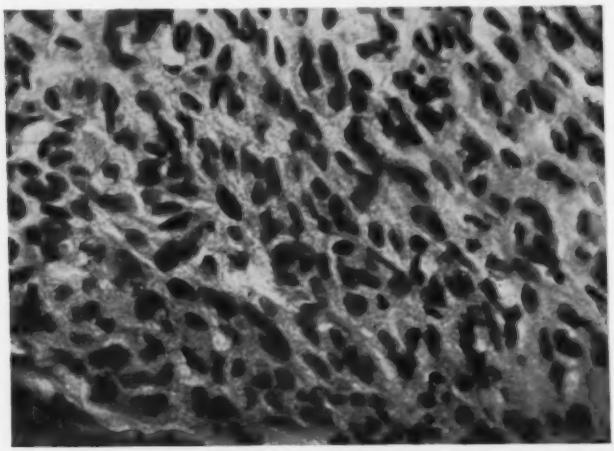

Fig. 12. Case 3. Photomicrograph of tissue removed at a later date. Note the elongated cells and the resemblance to sarcoma. This illustrates the difficulty in diagnosis described by Ewing. Hematoxylin and eosin stain (×430).

delaying the diagnosis. The enlargement and destruction of the sella turcica were quite suggestive of pituitary tumor and yet there were no general signs of pituitary dysfunction. Clinically, the intranasal tumor was thought to be a sphenoid malignancy or chordoma.

Diagnosis of the tumor, as in the two preceding cases, was made on the basis of intranasal biopsy.

Ewing's statement that positive identification of these tumors is often difficult was borne out in the course of this patient's illness. Tumor tissue was obtained on six occasions,

twice via intracranial exploration and four times during the palliative removal of the recurring intranasal mass. The slides were examined by several competent pathologists and neuropathologists, some of whom remain doubtful as to its exact classification. The majority opinion favored chordoma and this was supported by the clinical aspects of the case* Untreated cases are said to run an average course of 2.8 years.

The palliative removal of recurrent tumor tissue in the nasal passages enabled this patient to live comfortably for approximately 18 months after her condition was known to be hopeless.

SUMMARY AND CONCLUSIONS.

Certain intracranial tumors involving the region of the sella turcica are known to invade the sphenoid sinuses, nasopharynx and nasal passages by direct extension. The most common of these are the pituitary adenomas and chordomas.

The clinical and pathological aspects of craniopharyngiomas, pituitary adenomas and chordomas have been briefly reviewed, with particular reference to their extracranial invasion.

The case histories of three patients have been presented in detail. In each instance, diagnosis of the specific intracranial lesion was made upon microscopic examination of tissue removed from the nasal cavities or nasopharynx. Two of the patients had typical malignant chromophobe adenomas of the pituitary gland. The third patient had a chordoma of the spheno-occipital type.

Headache, nasal obstruction and excessive postnasal secretion are probably the most common symptoms encountered by the otolaryngologist. Their significance becomes increasingly important with the realization that these same symptoms may be manifestations of the extracranial extension of sellar neoplasma.

The responsibility of the otolaryngologist is self-evident.

*Necropsy, obtained since submission of the manuscript, confirmed the diagnosis of chordoma.

Every patient with a known or suspected lesion of the anterior or middle cranial fossa should have a careful nasopharyngeal examination, this study to encompass the utilization of all available diagnostic aids. Lateral views of the sphenoid sinuses and sella turcica should be included in routine Roentgenograms of the nasal accessory sinuses. The necessity for microscopic study of all nasal polyps is again emphasized.

The author expresses appreciation to the following individuals for their interest and aid in connection with various aspects of this report: Dr. M. Ashkenazy, Dr. H. Halley, Dr. G. M. Hass, Dr. R. W. Lichtenstein, Dr. W. L. McNamara, Dr. R. Richter, Dr. S. G. Taylor and Dr. A. Ver Brugghen.

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THE HEARING ACUITY, TINNITUS AND VERTIGO IN ESSENTIAL HYPERTENSION.*

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The purpose of this paper is to report our findings of the hearing acuity and related symptoms of tinnitus and dizziness as observed in 76 consecutive cases of severe essential hyper tension admitted for splanchnicectomy to the Massachusetts Memorial Hospitals.

In addition to the detailed hypertensive study carried out, these patients were subjected to an otolaryngological survey, consisting of a local history and examination and audiometric study of their hearing acuity. Each patient was questioned and examined by one of us or by our resident in otolaryngology, Dr. Philip S. Spence, Jr., with the intent of analyzing the data thus obtained to determine the relationships, if any, of symptoms referable to the ears, nose and throat and the hypertensive state. Accordingly, a simple questionnaire was devised (see Chart 1), to which the audiograms were attached. The findings referable to the nose and throat will be reported in a subsequent communication.

In the group studied there were were 40 males and 36 females. No significant otological variations based on sex were noted. The majority of the patients were operated upon by members of the Smithwick Foundation and were observed by us both before and after operation. The postoperative period of observation was too brief to warrant any conclusions at this time.

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CHART 1. EAR, NOSE AND THROAT QUESTIONNAIRE USED IN COMPILING DATA.

PREOPERATIVE.

Patient's Name Age Male Female

	Yes	No
1. Are you troubled with nasal obstruction?		
2. Do you have allergy or hay fever?		
3. Any history of sinus trouble?		
4. Are you ever dizzy?		
5. Are you subject to headaches?		
6. Do you have ringing in the ears?		
7. Have you noted any defect of hearing?		
8. Are you subject to nose bleeds?		
Physical Examination:		
Nose and Throat:		
Ears:		
Audiograms		

POSTOPERATIVE.

	Yes	No
1. Have you noticed any change in your ability to breathe through your nose?		
2. Are you dizzy now?		
3. Do you have any change in hearing acuity?		
4. Do you have ringing in the ears?		
Physical Examination:		
Nose and Throat:		
Ears:		
Audiograms		

The frequency of tinnitus, dizziness, deafness and the audiometric findings of a dip in the 2,896 and 4,096 d.v. frequencies by air conduction is shown in Table 1, which summarizes these findings for the different age groups of the patients studied.

TABLE 1.

Age Group	No. of Cases	Tinnitus No.	Tinnitus %	Dizziness No.	Dizziness %	Deafness (Subjective) No.	Deafness (Subjective) %	Dip in Audiograms at 2,896 and 4,096 d.v. No.	Dip in Audiograms at 2,896 and 4,096 d.v. %
23-29	4	1	25	2	50	0	0	2	50
30-39	16	7	44	7	44	1	6	7	44
40-49	42	11	29	18	43	4	9	15	36
50-56	14	4	29	8	57	3	21	8	57
Total	76	23	30	35	46	8	10	32	42

Tinnitus: Twenty-three, or 30 per cent, of our patients complained of noise in the ears. This was most often of a

ringing quality, intermittent in occurrence, and only infrequently incapacitating. We should like to note, in passing, that in the few patients who had severe constant tinnitus and complained of a throbbing or pounding sensation, there was gratifying cessation or improvement in the tinnitus after splanchnicectomy. It will be noted that tinnitus was as frequent in the younger age group as in those in the sixth decade.

Vertigo: Dizziness was a very common complaint, occurring in 46 per cent of our cases. In nearly all cases this was not the violent type of vertigo, nor was it associated with nausea or vomiting, loss of equilibrium or nystagmus. Most often the vertigo was mild or moderate in severity, recurring frequently, often a sense of giddiness or faintness or slight imbalance. In two patients the dizziness was associated with change of position and occurred upon lying down.

There seemed to be no correlation between the severity of the vertigo, the age of the patient, or the degree and duration of hypertension. This is in accord with the observations of Furstenberg.[1] Frequently there was marked improvement in the vertigo after splanchnicectomy. Two of the patients noted the occurrence of mild vertigo in the erect position shortly after the operation which may be related to the fall in blood pressure on standing, since postural hypotension, varying from slight to marked, is the rule in the acutely denervated state.

Furstenberg[1] has emphasized that the improvement or disappearance of the vertigo following splanchnicectomy is "obvious evidence that the hypertensive disease acts somewhere upon the equilibratory mechanism to produce vertigo"; however, we were impressed with the rarity of true labyrinthine vertigo in these patients as evidenced by the absence of nystagmus, nausea and vomiting, loss of balance and the relative infrequency of deafness in our group. The explanation may lie, in part, in the general vascular changes produced by the operation. Lewy[2] has stressed the possibility of vertigo resulting from drugs, notably the barbiturates, so commonly used for hypertension. The part played by emotional instability is difficult to evaluate but is no doubt a factor in some cases.

Deafness: Defective hearing was seldom complained of by the patients in our groups. As will be noted in Table 1, only eight, or 10 per cent, of the patients studied were aware of any hearing loss. In four of these, the defective hearing was found to be of the conduction type and resulted from such causes as middle ear infection in the past (two cases), nasal obstruction by polyps and thickened and retracted drums (one case), and atrophic nasopharyngitis (one case). One patient showed a mixed deafness and had a characteristic history and findings of moderately advanced otosclerosis with nerve damage. The three remaining cases, all in the older group, showed a nerve deafness with marked high tone loss. In one of these the deafness antedated the known history of hypertension.

While subjective deafness was an uncommon finding, we were impressed with the great frequency of a drop or dip in the air conduction audiometric curves at the frequencies 2,896 and 4,096, just above the speech range, often associated with a rise in the higher tones (5,792 and 8,192) by air conduction and with normal bone conduction in the frequencies commonly tested (512, 1,024 and 2,048 d.v.). This "audiometric dip" was observed in 32 cases, or 42 per cent of the total group. It will be noted from Table 1 that this phenomenon does not seem to be related to the age group, as it was approximately as common in the third decade as in the sixth. To our knowledge this "dip" which causes no subjective awareness of deafness has not been described previously in hypertension; however, similar "dips" have been frequently observed in individuals exposed to the trauma of gunfire and have been ascribed to injury in localized areas of the organ of Corti in the cochlea. It seems to us not unlikely that hypertension may exert a similar traumatic effect upon the cochlea, and that, conversely, this finding in the audiogram should suggest the possibility of hypertension. Several typical audiograms are shown in Chart 2.

SUMMARY AND CONCLUSIONS.

1. The hearing acuity and the frequency of tinnitus and

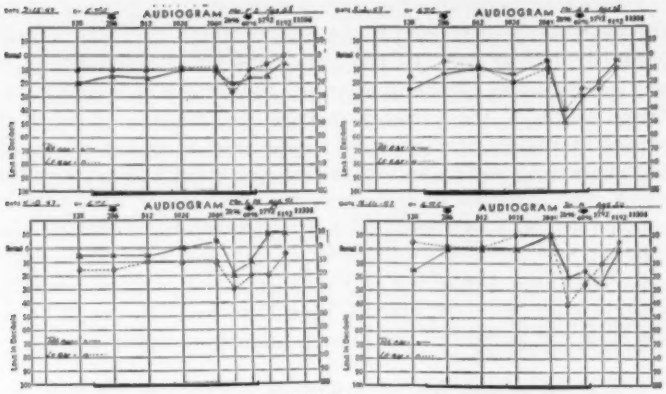

CHART II

Audiograms of patients ages 28, 38, 41, and 50, showing typical "dip" in the 2896 and 4096 frequencies with excellent hearing for conversation

dizziness were studied in 76 cases of severe essential hypertension.

2. Vertigo and tinnitus were found to be very common complaints in hypertensive individuals, occurring in 46 and 30 per cent of cases, respectively.

3. Immediate postoperative relief from both tinnitus and vertigo was observed in many of these patients. A detailed analysis of several hundred splanchnicectomized patients is now being conducted to observe whether the relief from these common and annoying symptoms is permanent.

4. Deafness was a relatively uncommon complaint, occurring in 10 per cent of cases.

5. A dip in the audiometric curve at the frequencies 2,896 and 4,096 was noted in 42 per cent of cases. A possible explanation is offered.

6. A complaint of vertigo and tinnitus, especially if associated with a drop in the audiograms at the 2,896 and 4,096 frequencies, may indicate study for the possibility of essential hypertension.

We acknowledge our indebtedness to Dr. Reginald H. Smithwick and his staff for making this study possible, and to the Misses Elizabeth T. Cummings, R.N., and Gail Kennedy for their assistance in the audiometric studies.

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THE DIAGNOSIS AND TREATMENT OF HAY FEVER WITH PARTICULAR REFERENCE TO THE RAGWEED TYPE.*†

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The diagnosis and treatment of hay fever, especially the ragweed type, have always presented important problems to the otolaryngologists. Some treat their own patients, some refer them to the allergist. In many communities, however, the services of the allergist are not available, so the problem must be managed by the otolaryngologist.

Most of the standard methods of treatment involve the administration of a long series of injections, starting with a small dose and gradually increasing to the largest dose tolerated by the patient. This method of treatment, not infrequently, results in the production of constitutional reactions which may be very alarming or even fatal. There is great need, therefore, for a satisfactory method which does not involve a long series of injections and which is comparatively or practically free entirely of any risk of dangerous reactions.

In the majority of cases the satisfactory management of hay fever cannot be based simply upon the administration of some type of injection therapy. Treatment must be individualized and other important complicating factors must be taken into consideration.

In order to present some idea of the problems involved in the management of hay fever, we have selected for analysis a group of 75 patients, treated during the 1947 ragweed season, in whom complete studies were made.

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*Read at the meeting of the Middle Section of the American Laryngological, Rhinological and Otological Society, Inc., Columbus, Ohio, Jan. 19, 1948.

†Preliminary report of clinical investigation of the treatment of hay fever under the auspices of the Hansel Foundation.

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THE RHINOLOGIC DIAGNOSIS.

Hay fever is characterized symptomatically by the seasonal occurrence of attacks of sneezing, nasal obstruction, profuse nasal discharge and itching of the nose, eyes, and sometimes the soft palate. It is sometimes complicated by cough and attacks of bronchial asthma. Upon rhinologic examination, the nasal mucosa appears pale or edematous and boggy. The microscopic examination of the nasal secretions shows a marked eosinophilia. The first attack of hay fever experienced by the patient is often thought to be a common cold. Tree and grass hay fever are not infrequently considered as seasonal colds for some time before the true cause is established.

THE POLLEN SEASONS.

In the central states area the hay fever season begins about the fifteenth of March with the pollination of the trees. The grasses, dock and plantain begin about May 15, the goosefoots in late July, and the ragweeds about the fifteenth of August. The following list includes the most common trees, grasses and weeds, with their approximate dates of pollination:

TREES.

Primary Importance.

Elm (Ulmus)	Mar. 10 to Apr. 1
Poplar (Populus)	Mar. 20 to Apr. 10
Oak (Quercus)	Apr. 5 to May 5
Sycamore (Platanus)	Apr. 10 to May 1

Secondary Importance.

Maple (Acer)	Mar. 10 to Apr. 1
Cedar (Juniperus)	Mar. 10 to Apr. 1
Willow (Salix)	Mar. 25 to Apr. 15
Birch (Betula)	Apr. 5 to Apr. 25
Ash (Fraxinus)	Apr. 10 to May 1
Mulberry (Morus)	Apr. 10 to May 1
Hickory (Carya)	Apr. 15 to May 5

GRASSES.

June (Poa pratensis)	May 15 to June 5
Orchard (Dactylis glomerata)	May15 to June 5
Sweet Vernal (Anthoxanthum Odoratum)	May15 to June 5
Timothy (Phleum pratense)	June 15 to July 5
Red Top (Agrostis alba)	June 15 to July 5

DOCK AND PLANTAIN.

Dock (Rumex)	May 15 to June 5
English Plantain (Plantago Lanceolata)	June 1 to July 15

WEEDS—GOOSEFOOT FAMILY.

Kochia (Kochia scoparia)	Aug. 1 to Sept. 10
Lambs Quarter (Chenopodium Album)	Aug. 1 to Sept. 10
Mexican Tea (Chenopodium ambrosioides)	Aug. 1 to Sept. 10
Pigweed (Amaranthus retroflexus)	Aug. 1 to Sept. 10
Russian Thistle (Salsola Pestifer)	Aug. 1 to Sept. 10

RAGWEEDS AND RELATED SPECIES.

Giant Ragweed (Ambrosia trifida)	Aug. 15 to Sept. 25
Short Ragweed (Ambrosia elatior)	Aug. 15 to Sept. 25
Southern Ragweed (Ambrosia bidentata)	Aug. 15 to Sept. 25
Western Ragweed (Ambrosia Psilostachya)	Aug. 15 to Sept. 25
Marsh Elder (Iva ciliata)	Aug. 15 to Sept. 25
Burweed Marsh Elder (Iva Xanthifolia)	Aug. 15 to Sept. 25
Cocklebur (Xanthium speciosum)	Aug. 15 to Sept. 25
Sunflower (Helianthus annus)	Aug. 25 to Sept. 25
Goldenrod (Solidago speciosa)	Aug. 25 to Sept. 25
Mugwort (Artemisia absinthium)	Aug. 25 to Sept. 25

In the management of hay fever, botanical surveys and atmospheric pollen counts are important, for the data obtained therefrom must be correlated with the time of appearance of

the symptoms and the reactions noted from the diagnostic skin tests. If, for example, the attacks of hay fever begin in March, coinciding with an Elm pollen count of 25 or more, and the skin reaction to Elm is positive, the diagnosis can be definitely established and treatment administered accordingly.

THE CLINICAL HISTORY.

From the analysis of a detailed clinical history a great deal of pertinent information may be obtained. That there is a family predisposition to hay fever is shown by statistical analyses. In about 65 per cent of adults and 75 per cent of children there is a positive history of allergy. The past history not infrequently indicates that other manifestations of allergy already existed before the onset of the hay fever.

The age of onset of hay fever is almost always early in life and most sufferers are under the age of 40. In the group of 75 patients with ragweed hay fever herein reported, the age of onset of the attacks is shown in Table I.

TABLE I.

AGE OF PATIENTS.

	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-	
Male	5	9	7	10	5	3	—	1	= 40
Female	2	5	5	14	5	2	2	—	= 35
Total:	7	14	12	24	10	5	2	1	= 75

21, or 28 per cent under 21 years of age.
33, or 44 per cent, under 31 years of age.
57, or 76 per cent, under 41 years of age.
67, or 89.3 per cent, under 51 years of age.

AGE OF ONSET.

	1-10	11-20	21-30	31-40	41-50	51-60	61-70	
Male	16	9	10	4	—	1	—	= 40
Female:	7	10	10	5	2	1	—	= 35
Total:	23	19	20	9	2	2	—	= 75

Onset in 23, or 30 per cent by age 10 years.
Onset in 42, or 56 per cent, by age 20 years.
Onset in 62, or 82.7 per cent, by age 30 years.
Onset in 71, or 94.7 per cent, by age 40 years.

It is noteworthy that there were more than twice as many

males as females in the group with the age of onset before 10. This is also true among children with nasal allergy and bronchial asthma. After age 10 years the male and female groups are comparatively equal.

The ages of the patients at the time of treatment are also shown in Table I.

There were twice as many males as females under the age of 21 years. After that, the incidence between the two sexes was about the same.

HAY FEVER MAY BE ACQUIRED.

Although hay fever most frequently develops among those who have a familial predisposition or those who are already allergic, it may appear in normal individuals with no previous allergic background. We have encountered a significant number of instances in which hay fever developed as a result of massive exposure, in both the normal and the predisposed, more particularly in the latter group. Massive exposure may result from walking in the weeds at the time of maximum pollination, a cross-country trip in an automobile, or entering an area with high atmospheric concentration of pollen from one in which there is very little, if any. This is likely to occur about Sept. 1, when many people have occasion to return home from a vacation or a summer resort. This particularly applies to children and they are the most susceptible. We have made it a point to warn such patients not to return to our location from a pollen-free area before Sept. 10. We have noted a few patients who developed a sensitivity to goosefoot pollens in Kansas and Colorado during a vacation. These patients had symptoms from such pollens in St. Louis, although the counts were comparatively low. In the central states the onset of the ragweed season is so rapid and a high atmospheric concentration of pollen develops so quickly that a natural state of massive exposure exists.

With the introduction of the sugar beet industry into Arizona, Phillips[1] noted the development of sensitivity to beet pollen (goosefoot family) in a large number of allergic indi-

viduals after about two years of massive exposure. In another group of patients he noted the development of sensitivity to Johnson grass smut after five years of new exposure.[2]

Ragweed hay fever in European-born sufferers not infrequently develops at a later age in life. Clark and Leopold[3] state that such patients require the same "incubation period" after the first contact with ragweed pollen, regardless of their age at the time of first contact.

OTHER SENSITIVITIES AND ASSOCIATED MANIFESTATIONS.

Because of the high toxicity of ragweed pollen and the great atmospheric concentration, the patient develops a high degree of hypersensitivity during the season. As a result of this, other sensitivities and manifestations easily develop. Among the 75 patients in this series, nine were sensitive to trees, 26 to grass, and two to goosefoot in addition to the ragweed. Thirty-two had only seasonal hay fever, but 25 of them also reacted to foods and inhalants (see Table II). Of

TABLE II. RAGWEED HAY FEVER.

No. Pts.	Neg. Food and Inhal. Reactions	Pos. Food and Inhal. Reactions	Also Grass Reactions
Seasonal Ragweed 28	6	22	8
Seasonal R. W. with Asthma.. 4	1	3	2
Perennial Nasal Allergy.....23	4	19	8
Per. N. A. with Seas. Asthma.... 5	0	5	2
Per. N. A. with Per.Asthma 15	4	11	7
Total: 75	15	60	27

the entire group, 60, or 80 per cent, reacted to foods and inhalants. Four of the seasonal patients and five witih perennial nasal allergy had complicating asthma only with the hay fever. Forty-three of the group had perennial nasal allergy, bronchial asthma and other manifestations in addition to the hay fever, as shown in Table II. In the treatment of this group of patients it was necessary to take into consideration the additional pollen, food and inhalant sensitivities. The management of hay fever, therefore, is not a simple problem dependent only upon the administration of pollen therapy.[4]

DIAGNOSTIC SKIN TESTING AND TITRATION OF SENSITIVITY.

In planning the treatment for the hay fever patient, a detailed clinical history and complete skin testing are important. The history discloses the existence of associated manifestations and the skin test is an aid in revealing other sensitivities.

Figure I

SCRATCH TESTS

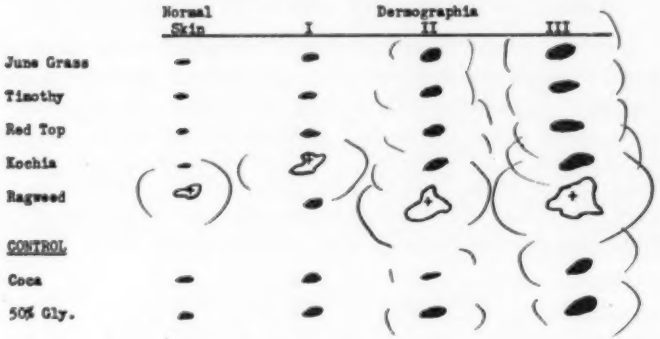


Fig. 1. Scratch tests.

In children under the age of 10 years we employ the scratch test, and in adults both the scratch and the intracutaneous. For all patients we use the scratch test for pollen testing. It is the safer method, the testing materals remain stable and always ready for use at any time of the year. Pollen extracts for intracutaneous testing must be made up into a number of dilutions of different strengths and must be freshly prepared about once a month. In preparation for injection treatment of hay fever, however, we use the various dilutions for making the intracutaneous tests to determine the relative degree of sensitivity.

In the interpretation of skin reactions it is important to take into consideration the variability in the reactivity of individual skins. Varying degrees of dermographia are fre-

quently encountered. The scratch test materials we employ contain 50 per cent glycerine. The pollens are 1 to 20, the foods and inhalants 1 to 10 dilution. False reactions in sensitive skins may occur from trauma and/or from the glycerine.

Figure II

INTRACUTANEOUS TESTS

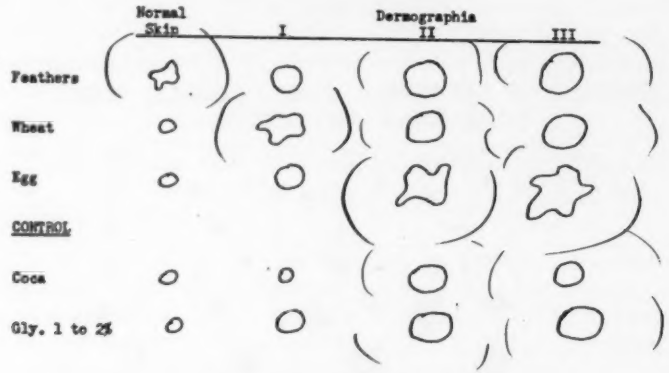


Fig. 2. Intracutaneous tests.

False reactions do not show pseudopods and there is usually an absence of itching but some degree of erythema. Positive reactions are usually larger on the more sensitive skins. Crossed reactions frequently occur among the various members of the grass and ragweed families. Skin reactions to pollens in hay fever are very consistent. False reactions must not be interpreted as positive. Occasionally definite positive reactions occur in the absence of a history of hay fever symptoms. These patients should not be treated until it is definitely established that actual hay fever occurs.

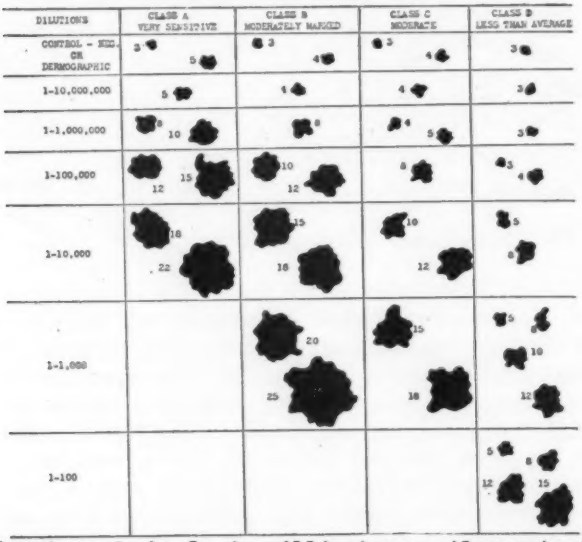
In intracutaneous testing, varying degrees of dermographia are encountered, as in the case of the scratch test. Control tests should be made with the diluent employed, such as saline or Coca solution. Extracts diluted from concentrates containing glycerine may still contain 1 to 2 per cent, so control tests

should be made with these solutions. Even in these small concentrations, glycerine may produce false reactions on very reactive skins. In some skins, however, the coca solution may react as much as the glycerine.

Sometimes it is very difficult to draw the line between a false positive and a true positive reaction.

Figure III

TREATMENT OF HAY FEVER. TREES, GRASSES, WEEDS.
TITRATION OF SENSITIVITY



Diameter of wheals in millimeters. Always test first with 1-10,000,000, 1-1,000,000 and 1-100,000 dilutions; then add 1-10,000 and 1-1,000 according to sensitivity.

Fig. 3. Treatment of hay fever. Trees, grasses, weeds. Titration of sensitivity.

Diameter of wheals in millimeters. Always test first with 1-10,000,000, 1-1,000,000 and 1-100,000 dilutions; then add 1-10,000 and 1-1,000 according to sensitivity.

Although the skin tests to pollens are very reliable, those to the foods and inhalants are much less so. The patient may not react to allergens to which he is clinically sensitive or a positive reaction may occur which has no clinical significance.

In this series of 75 patients the food and inhalants which most commonly reacted were as follows: wheat, corn, oats, rye, barley, chicken, turkey, milk, egg, cottonseed, pea, stringbean, peanut, soybean, tomato, white potato, pineapple, asparagus, onion, garlic, melons, spices and condiments, house dust, molds, feathers, orris, pyrethrum, horse, cow, dog and cat hair.

THE TREATMENT OF HAY FEVER.

The management of hay fever involves two distinct problems: *1.* The control of nonpollen sensitivities. *2.* The administration of pollen therapy.

In the case of the patient who appears in due time before the onset of the pollen seasons, complete skin testing can be performed and it can be determined whether other manifestations of allergy such as perennial nasal allergy, bronchial asthma, gastrointestinal allergy or skin allergy are to be considered. The nonpollen sensitivities constitute a most important part of the problem. Among the 75 patients in this series, only 20 per cent showed negative skin reactions to foods and inhalants (see Table II). Even among those patients who have only seasonal hay fever, food and inhalant sensitivities may be present and must be controlled. If sufficient time is available in those instances in which other manifestations of allergy are present, these additional factors may be studied and evaluated. Some patients require dust and mold injections during the hay fever season; some must avoid certain foods. In some instances a strict elimination type of diet is necessary because all foods to which the patient is sensitive do not react by skin testing.

A significant number of patients continue to have nasal symptoms and sometimes asthma after the pollen season is over, because of complicating sensitivities. These symptoms may continue for one or two months or they may be perennial.

All hay fever patients must practice a certain degree of prophylaxis by avoiding common inhalants such as house dust, feathers, orris, animal danders, smoke and irritating vapors. No alcoholic liquors should be permitted. Smoking should be prohibited or highly restricted. Avoidance of those factors which involve greater exposure to pollen should likewise be practiced.

POLLEN THERAPY.

In the treatment of hay fever by the administration of pollen extracts, three different methods may be employed; namely, the preseasonal, the perennial and the unseasonal.

THE PRESEASONAL AND PERENNIAL METHODS.

The former is the one mostly employed. It consists of the administration of a series of injections, starting with a small dosage and gradually increasing over a period of about three or four months to the largest one tolerated by the patient. The initial dose is usually one unit and the maximum about 25,000 to 50,000 units. Initial and maximum doses are usually based upon the degree of sensitivity as determined by the scratch, intracutaneous or conjunctival tests. Some allergists employ a method of giving less dosage in a shorter period of time. After the first season the perennial method may be used, in which about one-half the maximum dosage is administered twice monthly and finally increased again before the next season begins. With the maximum or high dosage method, the question still remains as to whether protection or relief is obtained as the result of the production of a blocking antibody, or whether the patient reaches a state of "refractoriness."

Although this method is the one most commonly employed today, it certainly is not the one of choice for the novice. Local and/or general constitutional reactions may occur, sometimes to an alarming degree. Dosage must always be carefully calculated and administered. One must be thoroughly familiar with the management of reactions when they do occur.

Perennial and preseasonal treatments by the oral method have also been employed. The same plan of administration is used, starting with a small and increasing to a maximum dose. Top doses as high as 250,000 units have been given. On the whole, practically all reports on this method have been discouraging.

THE CO-SEASONAL METHOD.

When the patient reports for treatment at the onset or during the pollen season, this is the only method that can be employed. It consists of the injection or the oral administration of small doses of pollen extract.

For the past 10 years we have employed this method as the one of choice.[5] If properly planned, the method is safe and free from all dangerous reactions. It requires fewer treatments, is more economical for the patient and the results are very satisfactory.

Injection treatments are given subcutaneously or intracutaneously. Treatments are administered every one to three days. There is a certain small optimum dosage which gives satisfactory relief for the above periods of time. Uncomplicated cases are much more easily and satisfactorily controlled than those with complicating sensitivities. The dosages employed in treatment are arbitrarily based upon the relative degree of skin sensitivity as determined by the titration method. The test is usually performed just before the onset of the season, but may also be done during the season.

A control test with the dilutent employed should be made in order to determine the relative reactivity of the skin. In all tests, 0.01 to 0.02 cc. is injected, making an initial wheal of about 3 to 4 mm. First, the pollen dilutions of 10,000,000, 1,000,000 and 100,000 are tested, and recorded after 20 to 30 minutes. If a wheal 15 to 18 mm. is noted with the 100,000 dilution, it is not necessary to apply the 10,000 dilution. If the 100,000 dilution gives a 10 to 12 mm. wheal, the 10,000

solution may be added. We have found by clinical experience that a wheal about 18 to 20 mm. in diameter, created with 0.03 to 0.05 of a given dilution, produces the best effect. If, for example, 0.01 to 0.02 of the 100,000 produces a 15 mm. wheal, 0.03 to 0.05 will produce a wheal 18 to 20 mm. in diameter. Most patients are treated with the 100,000 and the 10,000 solutions. In only a small percentage of cases is the 1,000 solution necessary. The intervals between treatments are regulated according to the degree and length of period of relief. In giving subcutaneous injections, the same dosage may be used in dilution 10 times weaker. That is, instead of injecting 0.03 of 100,000, inject 0.30 of 1,000,000.

During the past two years we have been experimenting with a small dosage oral method which is still under clinical investigation, so only a few preliminary remarks can be made about it at this time. In some cases we have employed the oral method entirely with satisfactory results. In other instances we have used it in conjunction with intracutaneous or subcutaneous injections.

SUMMARY OF RESULTS OF RAGWEED THERAPY IN 75 PATIENTS TREATED IN 1947.

From a group of about 200 patients treated for ragweed hay fever during the 1947 season, 75 in which complete studies and observations were made have been selected for analysis in Table III.

TABLE III. RESULTS OF RAGWEED THERAPY.

	No. Pts.	RESULTS None	Poor to Fair	Good	Very Good	Excellent	Food Avoid.
Seasonal Ragweed	28	1	2	4	10	11	18
Seas. R. W. with Asth.	4	—	—	1	3	—	1
Perennial Nasal Allergy	23	—	2	3	9	9	14
Per. N. A. with Seas. Asth.	5	—	1	2	1	1	4
Per. N. A. with Per. Asth.	15	—	—	4	7	4	7
Total:	75	1	5	14	30	25	44
Also Grass Sensitive	27	—	1	7	13	6	—
		6, or 12%			55, or 73.3%		
		20, or 26.7%			69, or 92%		
FOOD AVOIDANCE		1	3	10	15	15	44

All of the patients received daily oral therapy, and in the majority intracutaneous injections were given two to three times a week during the season. Treatment was started a few days to a week before the onset of the season. A few patients received only oral therapy, and most of them had excellent results. Patients who received intracutaneous injection were advised to omit the oral therapy on the day of the injection. In some instances an exacerbation of symptoms occurred when both treatments were taken on the same day. On the whole, the oral therapy appeared to maintain a more uniform dosage. Since oral dosage was individualized, it had to be manipulated at the optimum point. Further investigation may show that the injection can be eliminated entirely. Among the patients sensitive only to ragweed, the dosage was very easily controlled and the results were excellent in almost every patient. The same was true among the seasonal ragweed patients when certain foods were avoided. In the entire group, 44 patients avoided the foods which gave positive reactions, as well as those which were suspicious of being a factor. In only a few instances was a strict elimination type of diet recommended. We feel that a larger number should have been on the latter type of diet, as certain foods which did not react by skin tests were definite factors in aggravating the hay fever. It may be well to start all patients with food factors on an elimination type of diet and then add to it during the season if the patient is progressing satisfactorily. In this manner clinical proof can be established as to which of the important foods aggravate the symptoms. In a significant number of cases dust and mold injections were necessary during the hay fever season. In the perennial cases, dust and mold injections, as well as food avoidance were instituted throughout the year. Dosages of dust, mold and other inhalants were reduced from 10 to 100 times during the pollinating season.

During the 1947 season the grass counts remained low during the ragweed season, but some patients required supplementary treatment with the pollens. Two patients were sensitive to the goosefoot pollens which were added to the treatment. Incidentally, all of the goosefoot sensitive patients acquired the sensitivity in other areas where this type of hay

fever is common. Primary goosefoot sensitivity in our area is very rare because these pollens are not present in the atmosphere in significant amounts.

In the final analysis of the results obtained, only six, or 12 per cent, of the patients had none to poor or fair results. Sixty-nine, or 92 per cent, had good to excellent results. Fifty-five, or 73.3 per cent, had very good to excellent relief.

As in the past, future experimentation in the treatment of hay fever should continue to be directed to the immunologic solution of the problem. The alleviation or prevention of the marked local reactions and the consequent increases in the degree of general hypersensitiveness during the pollen season should materially decrease the tendency to induction of sensitivities to foods and inhalants and, finally, the addition of other manifestations of allergy.

DRUG THERAPY.

In this series of cases the use of drugs was almost entirely prohibited in order that their effect would not overshadow that of the pollen therapy. There were instances in which, however, a good result could have been converted to a very good or excellent one by the free use of drugs.

In a group of more than 100 patients not included in this series, the antihistamine drugs or ephedrine were recommended as needed. While some patients had excellent results with antihistaminic drugs, many could not tolerate them because of unpleasant side effects, or they gave no relief whatsoever. In these cases ephedrine could be substituted usually with satisfactory relief.

SUMMARY.

1. As an adjunct in the treatment of hay fever, pollen counts and field surveys should be correlated with the clinical history and the skin reactions.

2. Hay fever begins early in life, therefore most commonly affects individuals under the age of 40.

3. About 80 per cent of hay fever patients show additional sensitivities to foods and inhalants and 60 per cent have perennial nasal allergy, with or without other manifestations of allergy.

4. Hay fever may be acquired by massive exposure.

5. We have selected the co-seasonal method of treatment as the one of choice because it is safer, more economical and gives satisfactory results.

6. The control of extrapollen sensitivities is a very important part of the problem.

7. A preliminary report of a new method of oral therapy is presented.

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SOME PITFALLS IN SINUS SURGERY.*

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Human judgment is unfortunately a fallible thing. In matters of health, particularly when surgical measures for improvement are contemplated, errors may have serious and lasting repercussions. This is particularly so in the surgery of the nose and sinuses. We stand before the bar of public opinion for our too frequent failure, in the past, to satisfy the patient that he has had a satisfactory degree of lasting improvement from surgery in this area.

There are few other fields in which good results are dependent upon so many factors. In order that mistakes may be avoided, and omitting the consideration of surgical complications, these factors are:

1. Is it a condition which is subject to surgical correction or improvement in a satisfactory degree?
2. Which intranasal and sinus pathology needs correction?
3. Which type or types of operation should be performed?
4. Technique of these procedures.

1. Our most discriminating judgment is needed in determining susceptibility to surgical improvement. The various factors which tend to produce nasal and sinus malfunctions must be recognized and evaluated to prevent disappointment, for obviously it is a mistake to perform an operation, no matter how skillfully, in a situation which will not be materially improved by it.

In rank of importance, we must place the allergic states at the head of the list of these systemic conditions responsible for an ill-functioning nose. Failure to recognize its presence

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has accounted for many of our disappointments — particularly in those cases in which there is a combination of allergy and infection. A so-called sinus headache may easily result from a food allergy, gastrointestinal pathology or dysfunction, emotional disturbances, fatigue states, etc. Irritating fumes, unhealthy living habits, faulty diets must be recognized and properly evaluated.

2. Under this heading is the requirement that all present or anticipated pathology needs to be appreciated to avoid disappointment. Single isolated areas of infection in the nose are possible — such as a chronic suppurative maxillary sinus from an apical dental abscess, or a latent sphenoiditis; but the problem is most often a multiple one. Sinusitis present over an extended period tends to spread to adjacent areas. A pansinusitis on one side, which may even extend to the opposite side in sensitive individuals, frequently follows the above type of infection. An upper nasal blockade or tight upper nose, of some degree, is usually necessary to produce it. It is important that this pathology be adequately corrected at the same time. Or in reverse, an obvious septal blockade is corrected and a latent sphenoiditis or maxillary sinusitis not appreciated. The only death following nasal and sinus surgery in the speaker's hands followed an error of this kind — meningitis in the prepenicillin days, following a submucous resection. Autopsy showed activation of a slumbering sphenoiditis with a stalk through the sphenoid roof — a condition which the operator did not know the patient had and made no attempt to correct.

In the author's opinion, chronic infection of the olfactory fissure, with or without an associated ethmoiditis, is the least appreciated defect requiring surgical correction with which we deal. This pathology is usually not easily visible. It is hidden behind the septal tubercle or a hypertrophied middle turbinate — tight anaerobic contact areas between the septum and side wall of the nose; or if the patient complains of symptoms on the side opposite to a septal blockade, the diseased area may be found posteriorly between an obstructive middle turbinate and septum. This, it seems to the writer, is a most

important area for head pain of nasal origin, catching as it does the anterior and posterior ethmoid branches of the ophthalmic nerves in a sensitive inflamed area. Chronic suppuration is most common here, but rarely visible until blockades are removed. A substantial proportion of the cases of chronic postnasal discharge of a nonallergic nature are traceable to this. X-rays may be negative in the absence of ethmoiditis and the individual is passed along as a chronic complainer, or the bearer of a functional defect for which nothing can be done. It is a most frequent and important condition, doubly so as its diagnosis is less easy. Chronic ethmoiditis of a degree requiring surgical correction is also present and frequently unrecognized.

Thickening of the lining membrane of a maxillary sinus in the absence of frank pus may be overlooked. Frequently the use of opaque media and X-rays are necessary to determine it. We are all familiar with the hyperplastic lining containing cystic abscesses in an antrum from which no pus has been washed. The writer has been surprised at the frequency with which it is present in ethmoid cells — in an area which, so far as inspection and X-ray studies go, seemed insufficiently pathologic to harbor it.

Anticipated needs were mentioned. It seems obvious that if a strong septal deviation is returned to the midline, mechanical difficulties will arise on the side of the previous concavity. This requires some surgical modification of impinging structures on the lateral wall — projecting ethmoid cells, or turbinate bodies. Otherwise we may anticipate a disgruntled patient who will admit improvement on the improved side but will pointedly regret the necessity for a second operation on the newly obstructed side. Insofar as is humanly possible, the architecture of the nose must be reconstructed in such a way that the sinuses and intranasal structures will not only recover from the pathology of the present, but never again be capable of harboring infection in the old or in any new area.

3. To avoid mistakes, a proper selection of operative procedures should be made. This will be determined by the

experience and judgment of the operator. In general one might say that the surgery should be adequate. In the author's experience his mistakes have been almost altogether limited to underdoing rather than overdoing.

This does not need to be interpreted as extreme radicalism. As a matter of fact, our experience leads us to the contrary belief — that a substantial proportion of chronic nasal and sinus infection will be corrected by adequate ventilation and drainage. A major exception lies in that group where a marked uncorrectable allergic component exists, with irreversible hyperplastic membranous changes. It is those areas which are not adequately treated which are responsible for the patients' continued complaints. Some operators fulfill this need by doing radical surgery on all infected areas. If well done, the results here are largely satisfactory; but a more nearly normal physiologic result is attained by a combination of these endeavors, and the surgical experience of the patient is much less harrowing.

Of these cavities, the sphenoid and maxillary sinuses lend themselves best to simple and adequate ventilation by means of window resections. The nasal wall of each is of sufficient dimension that windows can be made to stay open. The difficulties which we have often encountered in maintaining patency in a small infected sphenoid attest to the truth of that statement by its presentation in reverse. Fortunately, here, the cavity may be easily and safely stripped of its membrane and allowed to fill in. It has astonished the writer how great the pathology a maxillary sinus may show and still become normal with a window resection, providing the upper sinuses are normal. When doing conservative surgery in an area that may possibly need more radical care later, regrets are avoided by telling the patient so beforehand.

Chronic frontal sinusitis, fortunately comparatively rare, may often be cleared up by adequate ventilation from below. A prognosis of this kind must be cautiously made, however, because of the extreme limitation of space which precludes a very generous "window." A severe degree of pathology here, or in supraorbital cells not surgically available to intranasal

approach, should be cared for by the external method. An additional incision at the lateral border of the brow may be needed in a few cases.

4. Of the many techniques which will not be productive of disappointment, the writer will mention only a few, as approximate agreement has been reached in most of them. It is axiomatic that nothing but absolutely necessary surgery of the simplest type be done during acute infection. The submucous resection must be meticulously performed. The upper portion particularly must be reached and made straight, so that no tenting results. The septal tubercle must be cleared away, entirely up to the nasal dorsum, or otherwise air currents will not reach the olfactory fissure, and if they do not, we will have a malfunctioning nose. Sufficient space (3 mm.) must be attained in the nasal roof. If the submucous resection does not produce it, the ethmoid box in certain cases may be crushed laterally; the upper anterior turbinate attahment can be removed — the amount depending on its obstructive nature; or a subturbinal ethmoidectomy can be done — and this is most useful, as then the medial wall of the ethmoid box can easily be displaced laterally and a beautifully functioning nose will result. As above stated, inadequate correction of the poorly ventilated olfactory fissure is an extremely comon pit into which we may fall; also, a chronic ethmoiditis, unappreciated and handled in a too tentative manner, is productive of disappointment. The cells often show hyperplastic changes in the membrane of sufficient degree that they will not recover by simple ventilation of the nasal roof. The membranous change probably would be reversible in the cells if adequate ventilation could be provided for each, but with a small ostium swollen shut, opening into a small cell, this often does not occur following such a simple procedure as a submucous resection, unless the changes are of a very moderate nature. Failure to amputate the cystic portion of a middle turbinate in which an infected cell exists is a mistake.

Intranasal ethmoidectomy carefully performed leaves no regrets but, contrariwise, is productive of most brilliant results. The cells must, however, be thrown into one single wide

cavity with no intervening septa and no membrane left to be incarcerated behind possible synechial bands. There are very few cases which fail to respond to these measures.

If the sphenoid is not obviously patent, it should be made so in every case. When in reasonable doubt an antrum window should be made. An obstructive lower turbinate should receive some modification at its anterior and lower portion.

Failure to suture together the margins of the incision in the canine fossa after a Caldwell-Luc is unwise as a fistula may result. In surgery of the complete or radical type, the painstaking removal of all infected membrane is necessary throughout, and economy of time and effort is to be avoided. Instead, a painstaking and meticulous attention to the surgical requirements is necessary.

CONCLUSION.

The mistakes which lead to disappointment in the handling of cases to be subjected to surgery of the paranasal sinuses include:

1. Improper selection of cases on which surgery is contemplated.
2. An incomplete understanding of the various sinuses which may be infected, and the faulty mechanics of the nose which may be basically responsible.
3. Improper selection of the type or types of surgery best suited to the correction of the diseased state.
4. The operative procedures must fit the accomplishment of the end-result: adequate correction of the pathology with due regard for the attainment of the most nearly normal degree of nasal function later.

BENIGN CYSTS OF THE ANTRUM, ORIGINATING FROM THE JAW OR TEETH.*

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In discussing antral cysts, it is first desirable to classify and define the various types of cysts found invading or encroaching upon the antral cavity; such cysts have not been frequently described in the literature on otolaryngology. In covering the available material, it was found that cysts arising from the antral mucosa have been reviewed by J. R. Lindsay. Cysts arising from the bone or from the teeth are frequently described in the journals of dentistry and oral surgery, but such cysts are rarely covered in the otolaryngological journals.

Antral cysts may be divided into two basic types:

I. Benign cysts arising from the sinus mucosa.

II. Benign cysts arising from the jaw or teeth.

The following table is compounded from the classifications of J. R. Lindsay, writing in THE LARYNGOSCOPE, February, 1942, and that of H. B. G. Robinson, D.D.S., writing in the *American Journal of Orthodontics and Oral Surgery*, 1945.

I. Benign Cysts Arising from the Sinus Mucosa.

1. Secreting cysts—including gland cysts and mucocele.

2. Nonsecreting cysts of the sinus mucosa.

II. Benign Cysts Arising from the Jaw or Teeth.

Developmental Cysts

A. Developmental cysts from odontogenic tissue

1. Peridontal cysts

a. Radicular or dental root
Apex type

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b. Lateral type
c. Residual type

2. Dentigerous or follicular cysts
3. Primordial cysts

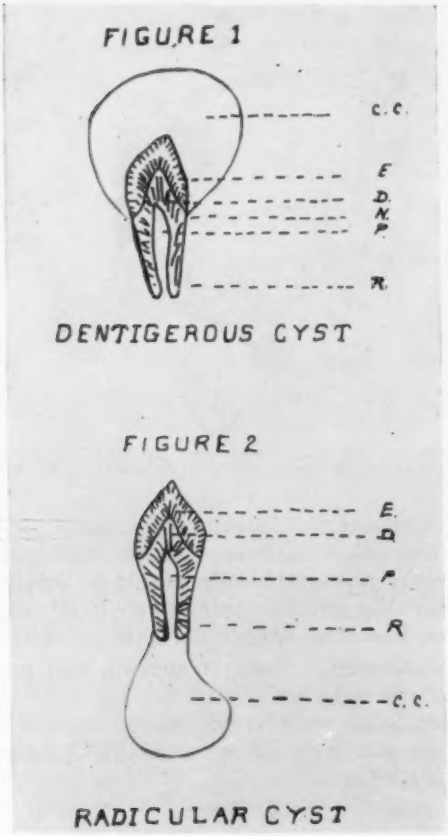

Fig. 1. Dentigerous cyst.

Fig. 2. Radicular cyst.

(C.C.) Cyst cavity, (E) enamel of tooth, (D) dentin, (P) pulp, (N) neck of tooth, (R) root of tooth.

B. Developmental cysts from nondental tissue

1. Median cyst (median palatine cyst)

2. Incisive canal cyst

3. Globulomaxillary cyst

III. Cystic Neoplasm (Dental Origin) — Ameloblastoma

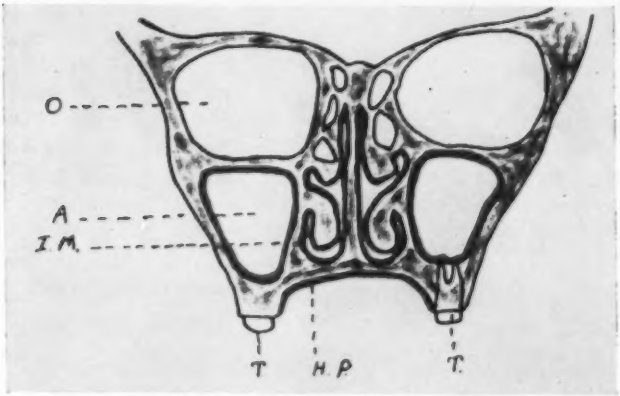

Fig. 3. Case 2. Schematic cross-section showing normal anatomy. (O) Orbit, (A) antrum, (T) tooth, (H.P.) hard palate, (I.M.) inferior meatus.

IV. For completeness of Radiographic and Clinical Diagnosis, the following lesions which may appear cystic, especially radiographically, should be kept in mind, although they are not truly cysts. They are formed of connective tissue and do not have an epithelial lining

a. Extravasation cysts (traumatic and nontraumatic hemorrhagic "cysts")

b. Neoplasms resembling cysts due to bone destruction

c. Metabolic dysfunction resembling cysts due to bone destruction

1. Osteoitis fibrosa cystica

2. Osteoitis deformans (fibrotic stage)

3. Xanthomatoses

4. Eosinophilic granuloma

5. Multple myeloma

d. Inflammatory disease resembling cysts due to bone destruction (pyogenic cysts)

It is the purpose of this paper to discuss only cysts of Type II, namely, true cysts arising from the jaw or mouth, and only those which may involve the antrum. Before doing so, it would seem a good idea first to review the anatomy of the maxillae, including the alveolus and the teeth.

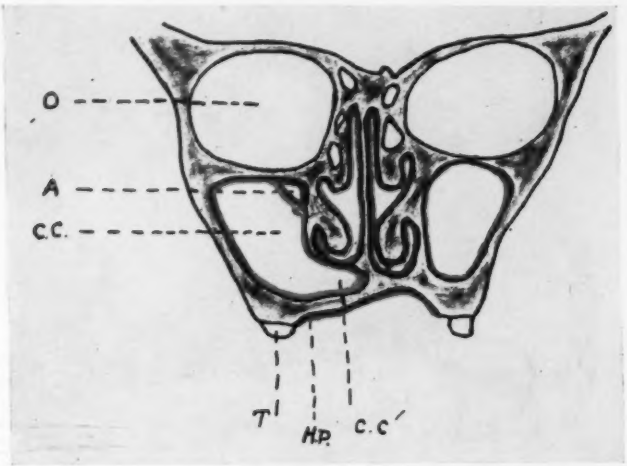

Fig. 4. Case 2. Schematic cross-section showing radicular cyst almost completely filling right antrum, displacing hard palate downward on right side, extending between floor of nose and roof of mouth. (O) Orbit, (A) antrum, (C.C.) cavity of cyst lying in antrum, (C.C.') cavity of cyst extending beneath floor of nose, (T) tooth, (H.P.) hard palate.

The maxillae are the largest bones of the face, excepting the mandible, and by their union form the whole of the upper jaw. Each assists in forming the boundaries of three cavities — *viz.:* the roof of the mouth, the floor and lateral wall of the nose, and the floor of the orbit.

Each maxillary bone consists of a body and four processes— zygomatic, frontal, alveolar and palatine.

The body is somewhat pyramidal in shape and contains a

large cavity, — the maxillary sinus (antrum of Highmore). It has four surfaces, namely: anterior, posterior (or infratemporal), superior (or orbital), and a medial (or nasal).

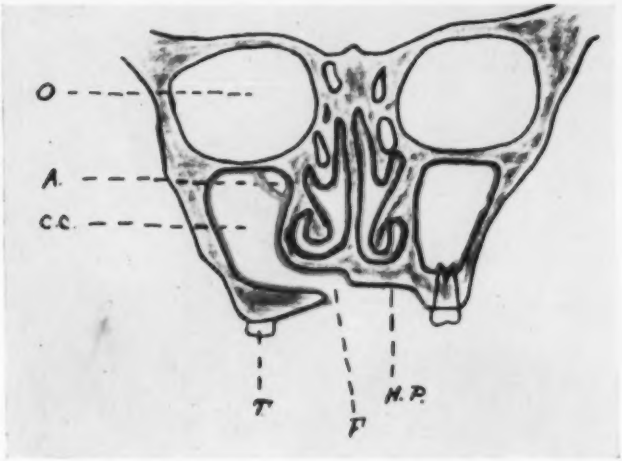

Fig. 5. Case 2. Schematic cross-section showing fistula conecting cavity of cyst with mouth. (O) Orbit, (A) antrum, (C.C.) cavity of cyst, (T) tooth, (H.P.) hard palate, (F) fistula.

The anterior surface of the body of the maxillae is directed forward and lateralward. It presents at its lower part a series of eminences corresponding to the positions of the roots of the teeth. Just above the roots of the incisor teeth is a depression, "The Incisive Fossa." Lateral to the incisive fossa is another depression, "The Canine Fossa." It is longer and deeper than the incisive and is separated from it by a vertical ridge, the canine eminence.

The maxillary sinus is a long pyramidal cavity within the body of the maxillae, its apex directed lateralward, is formed by the zygomatic process. Its base is the lateral wall of the nose. The antral walls are everywhere thin, and correspond to the nasal, orbital, anterior and infratemporal surfaces of the body of the maxillary cone. The floor of the antrum is

formed by the alveolar process of the maxillae, and, if the sinus be of average size, is on a level with the floor of the nose.

The alveolar process is the thickest, most spongy part of the maxillary bone. It is broader behind than in front, and excavated into deep cavities for the reception of the teeth. These cavities are eight in number, and vary in size and depth according to the teeth they contain.

Hajek states (Nasal Accessory Sinuses, Vol. 1, p. 22) that variation in the structure of the antrum is not shown in any of its other walls in such an outstanding manner as in the

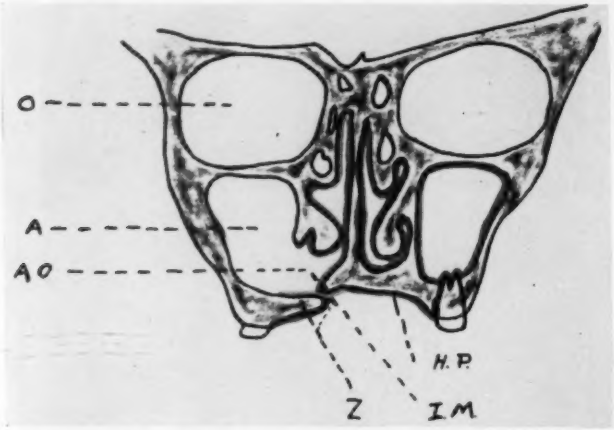

Fig. 6. Case 2. Schematic cross-section showing closure of hole in hard palate by shoving down floor of nose after exenterating cyst and making a large intranasal antrotomy. (O) Orbit, (A) antrum, (A.O.) antrotomy opening, (H.P.) hard palate, (Z) only portion of cyst wall which remains, (I.M.) inferior meatus.

floor. Frontal sections may show the floor of the antrum to be separated from the alveolus by an unusually thick, spongy, bony layer; while, in other sections, the floor of the antrum reaches deep into the alveolar process of the superior maxillae. Sometimes the apices of the roots of the teeth project through the thin floor of the antrum, in the form of alveolar prongs. The alveoli in the moderately thick alveolar process

appear as flat, rounded convexities in the floor of the antrum. In such a case, only the alveoli of the molars project, and the bicuspids and canine are located at some distance from the floor of the antrum. In a deep downward extending sinus, the alveoli of the bicuspids project into the antral floor; only rarely do the alveoli of the canine project.

Fig. 7. Case 1. X-ray 1. Lateral view showing aberrant tooth lying in antrum.

In a majority of cases, the maxillary antrum in its sagittal plane reaches from the first bicuspid to the third molar; in a small antrum, however, the bicuspid may lie anterior to the antrum. On the other hand, with a large cavity, the canine may lie in the region of the antrum. The region of the first molar and the second bicuspid represent the deepest part of

the antrum. The tip of the second bicuspid and the buccal roots of the first molar, when they are not atrophied, are usually in contact with the layers of the floor of the antrum.

Each tooth consists of three portions: the *crown*, projecting above (or below) the gum; the *root*, imbedded in the alveolus; and the *neck*, the constricted portion between the crown and the root.

Fig. 8. Case 1. X-ray 2. Anterioposterior view showing outline of cyst in right antrum.

The roots are firmly implanted in depressions within the alveoli. The depressions are lined with periosteum, which invests the tooth as far as the neck. At the margin of the alveoli, the periosteum is continuous with the fibrous structure of the gums.

In consequence of the curve of the dental arch, terms such as anterior and posterior as applied to the teeth are misleading and confusing. Special terms are, therefore, used to indicate the different surfaces of a tooth. The surface directed toward the lip or cheek is known as the "labial or buccal sur-

Fig. 9. Case 1. X-ray 3. Lateral view showing cyst filled with lipiodol introduced through fistula in tooth socket.

face"; that directed toward the tongue as the "lingual surface." Those surfaces which touch neighboring teeth are known as surfaces of contact.

On making a vertical section of a tooth, a cavity will be found in the interior of the crown and the center of each root;

it opens by a *minute orifice* at the apex of the root. It is called the *pulp cavity* and contains the *dental pulp*,—a loose connective tissue richly supplied with vessels and nerves which enter through the small aperture at the point of each root.

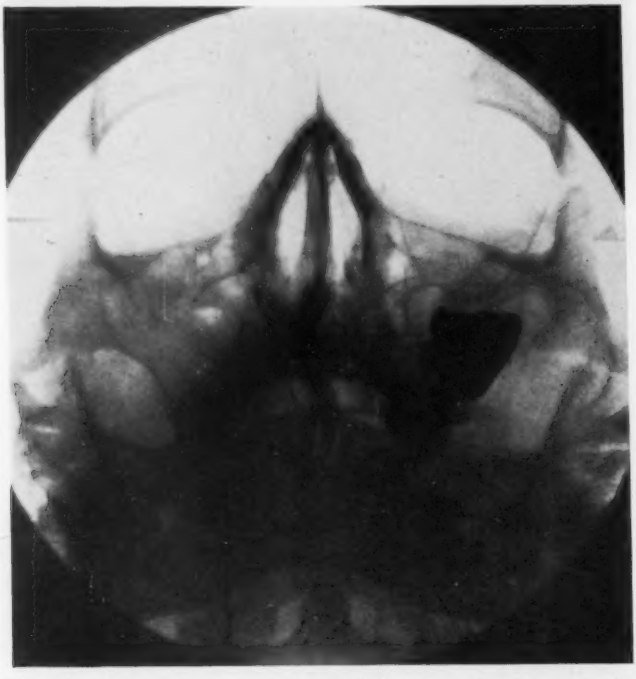

Fig. 10. Case 1. X-ray 4. Anteroposterior view showing cyst almost filling antrum. Cyst filled with lipiodol introduced through fistula in tooth socket.

The solid portion of the tooth consists of:

1. The ivory or dentin, which forms the bulk of the tooth
2. The enamel, which covers the exposed part of the crown, as far as the commencement of the root. (It is the hardest and most compact part of the tooth.)

3. A thin layer of bone, the cement which is disposed on the surface of the root

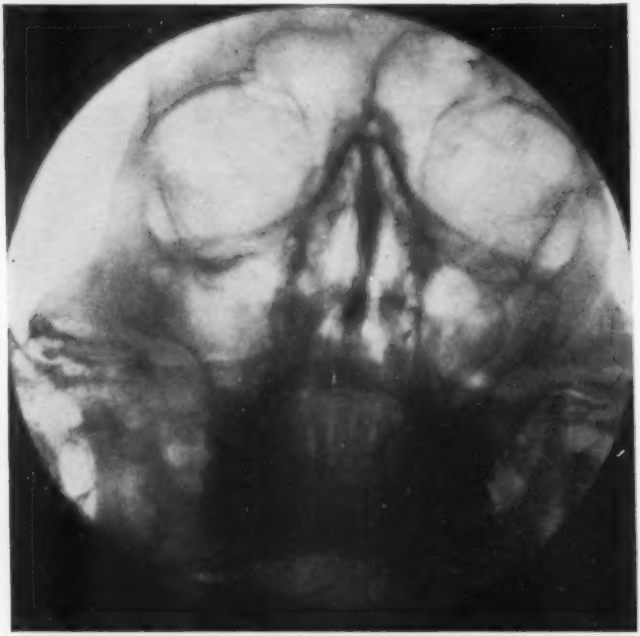

Fig. 11. Case 2. X-ray 1. Anterioposterior X-ray showing outline of large cyst occupying right antrum.

A complete set of upper teeth consists of:

Four incisors	—right and left central incisors right and left lateral incisors
Two canine	—right and left
Four bicuspids	—right and left first premolars right and left second premolars
Six molars	—right and left first molars right and left second molars right and left third molars

DEFINITIONS.

A cyst is a pathologic cavity lined by an epithelial sac and containing fluid or semisolid material.

Developmental cysts of the jaws are closed epithelium-lined sacs within the jaws, containing fluid or semifluid, and derived from ectodermal remnants.

Fig. 12. Case 2. X-ray 2. X-ray of roof of mouth, showing fistulous opening between cyst cavity and mouth filled with cotton impregnated with lipiodol.

A. From odontogenic tissue:

1. Peridontal cysts are those closed, epithelial-lined sacs, formed in the peridontal membrane and adjacent structures usually at the periapex of a tooth (type a), but sometimes along the lateral root surface (type b), which derive their epithelium from remnants of the dental lamina.

Synonyms: Dento alveolar; dento periosteal, radicular, root end, dental root, paradental.

These cysts may be subdivided into *dental root* apex or *radicular type* which occurs at the apex and which is usually preceded by chronic proliferative inflammation (dental granuloma) at the apex of the root of the involved tooth.

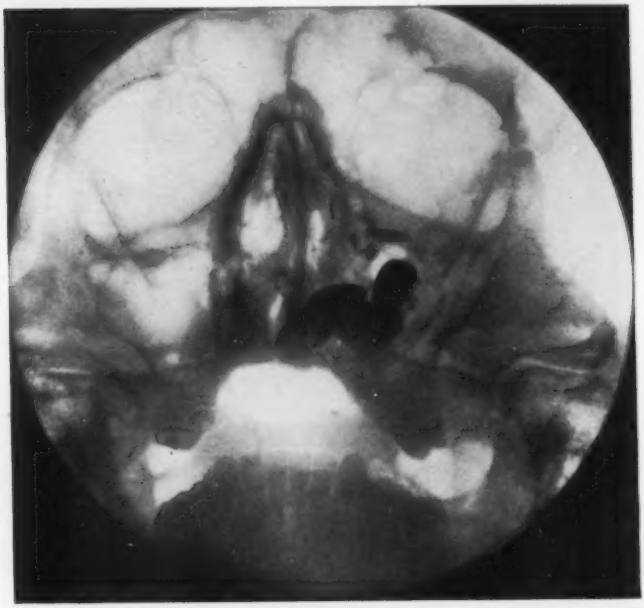

Fig. 13. Case 2. X-ray 3. Anteroposterior view showing lipiodol impregnated cotton passed up through fistulous opening and filling cyst cavity, which cavity almost fills the right antrum.

Lateral type, which occurs similarly but along the root surface.

Residual type, which may be left after the extraction of a tooth which had attached either a radicular or a lateral type cyst, or which may arise from the epithelium in the region of residual infection.

2. *Dentigerous cysts* are closed, epithelium-lined sacs

formed about the crowns of unerupted teeth or isolated tooth germs. They always contain tooth crowns or dental anomalies (odontomes). So-called "eruptive cysts," which occur especially on the distal end of third molars, are dentigerous cysts that have developed at a comparatively late stage of odontogenesis.

Fig. 14. Case 2. X-ray 4. Anteroposterior view showing lipiodol introduced into remaining antral cavity via natural ostium. Only a small portion of antral cavity remains unoccupied by the cyst.

Synonym: Follicular cyst.

3. *Primordial cysts* are those closed, epithelial-lined sacs formed through degeneration of the stellate reticulum in enamel organs before any calcified structures have been laid down.

Synonyms: Follicular cyst; dentigerous cyst.

B. From nondental tissue:

1. *Median cysts* are closed, epithelial-lined sacs, formed in the median fissure of the palate from embryonal remnants. They are situated between the two halves of the palate. They are lined by columnar or by squamous epithelium.

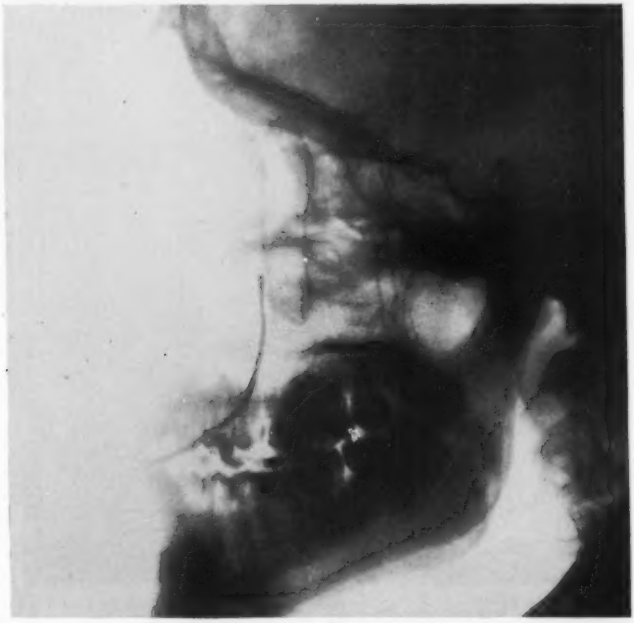

Fig. 15. Case 2. X-ray 5. Shows a probe passed through fistulous opening and passing up into the cyst cavity.

2. *Globulomaxillary cysts* are epithelium-lined sacs formed between the median palatine process and the maxillary process from embryonal remnants. They usually occur between the medial and lateral incisors, or between cuspid and lateral incisor.

3. *Incisive canal cysts* are sacs formed in the incisive foramen from embyronal remnants.

III. Cystic neoplasms of dental origin.

Ameloblastomas are embryonal neoplasms derived from cells with potentiality for enamel formation (oral epithelium, dental laminae). They are first solid, mimicking the amelogenic tissues, but later become cystic at the expense of their stellate cells at the center of the tumor follicles.

Synonyms: Adamantinoma; adamantino blastoma. While the ameloblastoma is from the same general primordium as the peridontal, dentigerous and primordial cyst, it develops as a neoplasm which becomes cystic, not primarily as a cyst, and for this reason is considered separately. It becomes malignant in about 45 per cent of cases.

DISCUSSION.

Peridontal cysts, of which *radicular cysts* (root cysts) are the most common type, have their origin in root granulomata, which result from a chronic periostitis. This periostitis is secondary to pulpitis caused by dental caries; such granulomata usually develop at the apex of the root, rarely on the lateral part of the root of the tooth. (Lateral Type) As a rule they are symptomless. They suppurate only when they become intensely infected either by continuity, by puncture or by rupturing.

These granulomata at the apex of a tooth really act as a protective wall against further spread of the infection from the pulp cavity. As these granulomata enlarge, they erode the spongiosa of the immediately adjacent alveolar wall. It also forms a resorption cavity in the base of the alveolus, in which the granulomata lies projecting from the apex of the root. It has been noted that these granulomata in their growth may resorb the alveolar roof and extend directly into the maxillary antrum without producing disease in the antrum, but in a

case of a severely infected cyst it usually causes an empyema of the antrum.

In its continued development the peripheral portion of the apical granuloma develops into a compact connective tissue membrane which is closely attached to the wall of the cavity, while the center of the granuloma forms a cavity lined with pavement epithelium and filled with a serous fluid. This conversion of granulation tissue into a cavity lined with epithelium is attributed to the persistence of remains of the epithelial portions of the embryonic pulp.

The real cause of the cyst formation is consequently a proliferation of the peridontal epithelium following inflammatory irritation.

The cyst cavity develops from hydropsical degeneration of the central portion of the granuloma. After a cyst once develops, it enlarges by the pressure of its fluid content, and it advances in all directions in order to gain space. It may shove the antral floor upward, or the palate downward; may bulge the lateral nasal wall toward the septum, or it may split the palate and pneumatize it.

As a rule the fluid in a maxillary cyst contains cholesterin crystals (Hajek). The walls of the cyst not infrequently contain numerous osteophytes.

Dryden, writing in the *Virginia Medical Monthly*, states that dentigerous cysts are much more common in the lower jaw and radicular (root cysts) are more common in the upper jaw (maxilla).

Edward C. Stafne, D.D.S., and J. A. Millhon, D.D.S., Mayo Clinic, writing in *The Journal of Oral Surgery*, April, 1945, report 500 periodontal cysts. They state that such cysts occur much more frequently in the incisor-cuspid region, and that cysts occurring in this locality far outnumber the cysts in all other regions. Three hundred thirteen of these 500 peridontal cysts were situated in the maxilla. In 349 instances the root

of the tooth in which the cyst had its origin was still present, and in the 151 instances remaining, the region in which the cyst was situated was endentulous.

Gullifer, writing in the *Journal of the American Dental Association,* Vol. 28, states: "Radicular cysts and root granulomas are associated with erupted teeth, roots usually devitalized, or areas from which such erupted devitalized or infected teeth or roots have been previously extracted."

The causative factor in granuloma is infection by bacteria that have invaded the pulp through primary caries, or secondary infection under fillings, or in root-treated teeth with subsequent invasion of the apical area. A pulp may lose its vitality from the proximity of a filling, or from trauma, with subsequent gangrene, but may remain quiescent as to symptoms. It is nonvital, nevertheless, and may give rise to either the root granuloma or the radicular cyst.

He stresses the point that a radicular cyst is an epitheliated granuloma. A differential diagnosis between granuloma and cyst cannot be made clinically unless it is very large, even with the aid of an X-ray. The diagnosis is made by the pathologist.

In a *granuloma* there is a wall of connective tissue, in which polymorphonuclear leucocytes, lymphocytes and plasma cells are found in abundance. The connective tissue is vascularized by many new thick-walled capillaries.

In the radicular cyst a protective connective tissue wall is likewise formed, and usually leucocytes are present; but in addition the inner portion of the connective tissue wall is lined by a layer of stratified, squamous epithelium. This epithelium originates from the epithelial remnants found at intervals throughout the normal peridontal membrane, located near the cementum and which have been left in the process of tooth development.

Waldron, writing on Cystic Tumors of the Jaws, in the *American Journal of Orthodontics and Oral Surgery,* 1941, p. 313, mentions that radicular cysts may sometimes not be

discovered in edentulous cases for 15 or 20 years after the teeth have been extracted (residual cysts).

DENTIGEROUS CYSTS (FOLLICULAR CYSTS).

Dentigerous cysts originate in retained or supernumerary isolated tooth germs. They develop from the tooth sacs and their origin from tooth roots is evident from one or more teeth projecting into the cystic cavity, their roots imbedded in the wall of the cyst. These cysts have a dense fibrous wall, with areas of thin shell-like bone, and a compact epithelial lining. These cysts are not attached to the root ends of erupted teeth as are dental root cysts but are found closely attached to an unerupted, often malformed, and usually misplaced tooth. The cyst wall generally encircles the tooth at the cementoenamel region, and the crown projects into the cyst cavity. The root, if formed at all, is usually outside the cyst wall and imbedded in the alveolar process.

A dentigerous cyst may be small or of such a size as to completely fill the antrum and encroach on the surrounding structures.

Blair and Ivy, Essentials of Oral Surgery, p. 306, state that unerupted third molars not uncommonly give rise to dentigerous cysts encroaching on the maxillary sinus.

Dentigerous cysts, states Waldron, are more likely to occur during the period of development and eruption of the teeth, hence they are common during the first and second decades.

Developmental cysts of nondental origin (median cyst, incisive cyst and globulomaxillary cyst) are readily diagnosed from their location and need not be dwelt upon here. They rarely involve the sinuses.

Cystic ameloblastoma are embryonal neoplasms, derived from cells with a potentiality for enamel formation. They are at first solid, later become cystic. The epithelium lining the cysts of ameloblastoma may vary from columnar through cuboidal to squamous type.

DIAGNOSIS AND SYMPTOMS.

Cysts of the jaws have to be differentiated from empyema of the maxillary sinus and from cysts of the mucous membrane. In general there should be no confusion since the symptoms are entirely different.

Cysts are usually symptomless except for the disfiguration caused by a large cyst; however, when they become seriously infected, they do cause fever, pain, discharge, etc. A characteristic evidence of a cyst is the protrusion of the bony wall toward the canine fossa with parchment-like crepitation.

In cases which have ruptured spontaneously, leaving a fistulous tract, a diagnosis can easily be made by injecting lipiodol into the tract and taking an X-ray.

Hardy, writing in the *Annals of Otolaryngology*, 1929, stresses the importance of a careful examination including X-ray of the teeth, dental examination for devitalized teeth, X-ray of sinuses (both with and without lipiodol), careful nose examination for possible bulging of the lateral nasal wall. Diagnostic antrum puncture, careful palpation of the roof of the mouth and of the cheek.

Christiansen, in the *Journal of Oral Surgery*, 1944, p. 308, makes a plea for multiple X-ray pictures from different angles, including the use of lipiodol in the antrum and the careful examination of the roof of the mouth. He believes that many cases where the antrum extends well down into the alveolus have been mistakenly diagnosed as cysts and have been needlessly operated upon.

The *diagnosis* of a dentigerous cyst is usually easy, especially with X-ray aid. A swelling of the bone is present, as is a thinning of the outer bony wall which crepitates when palpated and produces a sound resembling the crackling of an egg shell. If one of the permanent teeth is missing and there is no history of extraction, a dentigerous cyst should be suspected if any of the afore-mentioned symptoms are present.

The X-ray pictures will show an area of definitely destroyed

bone forming a cavity within the bone associated with an impacted or supernumerary tooth or teeth. Transillumination is of little value.

TREATMENT.

The treatment of cysts of the jaws (of the upper jaw particularly) must necessarily vary and depend upon the location and size of the cyst.

Manifestly, root cysts and dentigerous cysts that do not involve the antrum are out of the realm of the otolaryngologist. Treatment of these cases will vary from *1.* extraction of the offending tooth, combined with an incision in the buccal membrane and dissection of a small cyst, to a *2.* Partsch operation.

Christiansen states the Partsch procedure is based upon the principle of incision and drainage of the cyst and the maintenance of adequate communication with the oral cavity of which the cyst cavity becomes a part. In every case adequate exposure of the cyst cavity is necessary and a window must be maintained throughout healing.

In respect to those cysts which come into the realm of the otolaryngologist, opinion is somewhat varied.

Ivy (*Essentials of Oral Surgery*, p. 306)) states, "Rhinologists frequently treat cysts of dental origin encroaching on the cavity of the maxillary sinus as they would an infected sinus, making a large permanent intranasal window into the cyst cavity, leaving the lining behind, and making it an accessory maxillary sinus. He does not advocate this. If the pathological membrane is left behind, and there is only an intranasal opening, there is not sufficient opportunity for future control of a possible extension of the disease, and if an unerupted tooth is present, it cannot be removed via an antrotomy." He much prefers to approach all dental cysts involving the antrum through the vestibule of the mouth, and completely shell out the pathological membrane.

On the other hand, Carl W. Waldron, writing in the *American Journal of Orthodontics*, June, 1941, p. 315, states as fol-

lows: "A Partsch operation is particularly indicated in large cysts of the anterior portion of the maxilla that have destroyed the bony floor of the nasal cavity and a portion of the anterior wall and floor of the maxillary sinus, as their complete removal would of necessity open into the nose and the antrum. Such perforations produce a most unfortunate condition from the standpoint of nasal comfort, and the probability of efficient prosthetic restoration of missing teeth and lost portions of the maxilla. Leaving the cyst wall *in situ* not only prevents perforations into the maxillary sinus and nasal floor but also permits the retention of useful teeth that would necessarily be lost if the root ends were uncovered by the removal of the cyst wall, thus severing the blood supply of the pulp."

On page 31, Waldron continues: "In order to determine whether a complete enucleation of the cyst wall or a Partsch operation should be performed, I make it a routine first to establish an adequate window on the buccal surface to expose the cyst cavity. The cyst's contents are then completely removed by wiping with gauze, or, if necessary, by irrigation. The cyst lining is then carefully examined for evidence of perforation into the floor of the nose, the maxillary sinus, or through the palatal process. This may be ascertained by probing carefully with a blunt instrument. If all surfaces are found firm and resistant to the pressure of probing, the complete removal of the cyst wall by dissecting it from its bony cavity is the method of choice. If the probing demonstrates very small defects of the bony walls, careful sharp dissection will separate the cyst wall from the mucous membrane without danger of actual perforation, and formation of a fistula. If larger areas of nasal mucous membrane are exposed, they should be protected by leaving the cyst wall in place by means of the Partsch procedure.

"In cysts that are situated entirely in the posterior part of the antrum, without an extension of the cyst beneath the floor of the nose, the decision must be made whether or not the cyst cavity should be made to communicate with the remaining portion of the maxillary sinus by removal of the entire intervening cyst wall, followed by the establishment of an

adequate intranasal window in the inferior meatus of the nose. This is, in effect, the Caldwell-Luc operation — the so-called radical antrum procedure in which the oral incision is closed at the end of the operation. This method has in my experience (Waldron) been uniformly successful in every way, and has greatly shortened the postoperative treatment. This method obviates weeks or months of intraoral dressings."

Waldron coninues: "Formerly I always removed the cyst lining from the lower part of the cystic area in addition to removing the upper portion of the cyst wall that extends into the maxillary sinus. This leaves the denuded bone of the cyst cavity in approximately the same condition as the Caldwell-Luc procedure for chronic maxillary sinusitis after the removal of the infected membrane. The postoperative healing apparently follows the same course to complete resolution. The growth of a cyst, however, may encroach upon the root ends of underlying teeth, producing resorption of the apical portions of the roots, without, however, cutting of the blood supply of the dental pulps, as there develops an anastomosis of the vessels of the cyst wall with those of the pulp. On this account vital teeth may be retained to function normally for many years, providing the root ends are not exposed and cut off from their blood supply by the surgical removal of the cyst membrane.

Another problem that warrants detailed discussion is that of treatment of large cysts that not only obliterate the maxillary sinus but also extend under the floor of the nose. Such cysts sometimes extend past the midline beneath the floor of the nose. If a Partsch operation be performed, the postoperative course may extend over months or a year or more. If the Caldwell-Luc modification is performed, the cystic area beneath the floor of the nose constitutes a pocket where exudates collect, become foul-smelling, and give the patient no end of annoyance and discomfort. To prevent this postoperative condition, a two-stage procedure has given gratifying results.

The first procedure is a Partsch operation exposing the antrum, or extension of the cyst cavity but not uncovering it

completely on its labial aspect. It is then treated postoperatively in a routine manner by gauze packing twice a week until the anterior extension of the cyst has filled in sufficiently to obliterate that portion of the cavity that was present beneath the floor of the nose. It may take several months to accomplish this; then the Caldwell-Luc cyst procedure may be undertaken, and the oral incision that had remained open since the first operation is closed by undermining and suturing."

In any case where a portion of the cyst wall is left in to prevent fistula formation or to shorten the postoperative course as outlined, it is essential to have a microscopic examination of that portion of the cyst wall which was removed, in order to rule out the possibility of an adamantoblastoma, which, although rarely found, must be kept in mind.

The present writer strongly supports the latter method, as described by Waldron, for all cysts which involve the antrum; that is, performance of a Caldwell-Luc operation, thereby exposing the anterior wall of the cyst and opening into it, continuing to remove the anterior wall upward and shelling out the cyst from the antral cavity. When the floor of the cyst is approached, it may be advisable to leave that portion of the cyst wall if its removal is liable to create a fistula through the soft palate, or is liable to interfere with the blood supply of the adjacent teeth. A large intranasal antrotomy opening should, of course, be part of the Caldwell-Luc procedure. Another point in the Caldwell-Luc procedure is to be sure that the removal of the anterior wall of the antrum does not extend downward to the level of the gum incision. If this is done, there will be no difficulty in having the gum incision heal without even the introduction of sutures.

I feel the following two cases recently treated by this method support my belief in its efficacy.

Case 1: Dentigerous Cyst: Mr. E. was referred in March, 1945, by an orthodontist. He gave a history of removal of an upper first molar tooth in February, 1945. The tooth socket failed to heal and there persisted a fistula which led upward into a large cavity, which was believed at first to be the antrum. A probe could be passed upward through the fistula for a distance of one and one-quarter inches; however, on washing out

the antrum via the natural ostium, no fluid came out through the fistulous passage.

Lipiodol was then introduced into the antrum via the natural ostium, and the radiologist's report was as follows: "Flat plates of the antral sinuses show mucoperiosteal thickening of the left antrum. Within the right antrum is a sharply demarcated shadow with a radiolucent center and clear-cut periphery. This may represent a cyst. In addition, there is a tooth projecting into the floor of the sinus. Following lipiodol injections, there is incomplete filling of the antrum. On the later projection the cyst is incompletely outlined. The tooth is again seen. Impression: antral cyst-tooth in floor of sinus."

This confirmed our suspicion that we were dealing with a large cystic cavity which lay within the antrum but did not communicate with the antral cavity. For further confirmation, lipiodol was introduced into the cavity of the cyst through the tooth socket fistula and further X-rays taken on May 1, 1945. These showed the lipiodol filling the cyst cavity but not entering that portion of the antral cavity which remained unoccupied by the cyst. All X-rays revealed the presence of an impacted tooth lying in the posterior portion of the antrum. Both the orthodontist and myself felt this to be a dentigerous cyst and advised operation.

Operation was performed on May 10, 1945. Dr. L. (orthodontist) made a horizontal incision in the gum above the right upper molar teeth. This incision was enlarged by a vertical incision, thus creating an inverted T-incision. The soft tissues were elevated and the cystic cavity was entered, using a chisel and mallet. A wide exposure was made and conderable portion of the lateral wall of the cyst removed. The impacted tooth was visualized and removed.

From there on, the operation was turned over to me (otolaryngologist). The opening in the anterior wall of the antrum was enlarged upward with a Citelli punch. About half way up the antral wall, the anterior wall of the cyst and the anterior wall of the antrum became well differentiated as separate structures, and the dome of the cyst could be defined lying in the antrum. The cyst was readily separated from the antral wall, using a Freer elevator, despite the fact its wall contained a quantity of thin bony tissue. After complete removal of the cyst, a wide intranasal antrotomy was made below the inferior turbinate, and the wound was closed with silk sutures.

The pathologist's report was as follows: "Specimen consists of half a dozen fragments of tissue that appear to have constituted part of a cyst wall. Flat, shell-like pieces of bone are attached to some surfaces. The tissue is firm, white and dense. A deformed tooth with a single broadened root is included. Microscopically, sections show dense, chronically inflamed connective tissue surfaed on one side by stratified squamous epithelium and on the other by patches of respiratory epithelium. Patches of granulation tissue and trabeculated bone are included in the cyst wall. Diagnosis: Dentigerous cyst."

The patient made an uneventful postoperative recovery, except for the persistence for several months of a pin-point fistula. The antrum, however, was clear, there was no discharge and no odor. I attributed the persistence of the fistula to the fact that the removal of the anterior bony wall extended down to the line of incision in the gum. There was no "overlapping," such as is used in carpentry.

Case 2: Radicular Cyst: Mr. S. D. was referred to me on Jan. 4, 1947, because of an opening in his hard palate near the midline, through which the oral cavity communicated with what proved to be the antrum. He

had great difficulty eating and drinking, and his voice was much the same as that of an individual with a cleft palate.

He gave a history that for the previous year and a half he had noted that the right side of the roof of his mouth bulged downward in the form of a tumor. It had gradually increased in size until it interfered with his chewing. There had never been tenderness, and there was no history of dental abscess or other dental symptoms. He then visited Dr. K., who referred him to the hospital for X-ray of the palate. This was done and no dehiscence in the hard palate was noted. Accordingly, under general anesthesia, Dr. K. incised the swelling where it felt soft, just to the right of the midline of the palate and posterior to the incisive foramen. A quantity of clear fluid was obtained and it was revealed that there was destruction or congenital absence of a portion of the bone of the hard palate, for a suction tip could be pressed upward for an inch and a half.

The incision failed to heal and continued to drain slightly. Accordingly, he was referred for closure of the hole in the palate.

Examination revealed a downward bulge of the right side of the hard palate. The bulge was firm to palpation except for an area near the midline, where was situated an opening about three-fourths of an inch long and one-fourth of an inch broad, lying about one-half inch behind the incisive foramen. A probe passed upward through this opening could not be seen in the nose. The septum was deviated to the left and the floor of the right nostril was very elevated, the floor appearing jammed up against the right inferior turbinate, which appearance was not noted in the left nostril.

Patient was sent for X-ray examination. First, the usual X-rays were taken, and then further pictures were made in which a strip of gauze, impregnated with lipiodol, was passed through the fistulous opening into the cavity above. Report was as follows: "Examination of the right antrum shows clouding and mucoperiosteal thickening. There is a large circumscribed shadow containing air, which probably represents a mucocele. Following injection of lipiodol through the roof of the mouth, outlining the mucocele, there showed a direct communication between the cleft in the palate and the mucocele."

About a week later, an attempt was made to outline the cyst by the injection of lipiodol into the antrum via the natural opening. It was found that very little lipiodol could be injected before it overflowed into the nose. X-ray showed only a small portion of the antrum, just below the orbit and adjacent to the ethmoids, to contain lipiodol. It was felt that the cyst occupied the remainder of the antral cavity.

The cyst was removed by operation on Jan. 21, 1947, under general anesthesia. The usual Caldwell-Luc incision was made, soft tissues elevated. Anterior wall of the maxilla was found to be very thin, and crackled under pressure. Antrum wall was opened and opening enlarged with a Citelli punch. A large cavity was then visualized, about the size of a large walnut, which was lined with pale pink, thick membrane. The bone around the tooth sockets was soft and rather mushy. On enlarging the opening in the anterior wall of the cavity upward, a small space could then be seen between the cyst wall and the lateral wall of the nose.

A Freer elevator was inserted in this space and with a sweeping motion a line of cleavage was found between the wall of the cyst and the lateral nasal wall. The cyst was then gradually dissected free from the antral wall. It was in contact with the antral wall throughout, except for a small space just below the orbit near the natural ostium. The cyst had

extended between the floor of the right nostril and the roof of the hard palate until it reached medially a little beyond the midline.

The fistulous opening between the cyst and the oral cavity was well visualized.

The cyst wall was completely removed, except *1.* that portion covering the hard palate in the neighborhood of the fistulous opening, *2.* that portion which formed the floor of the right nostril.

A large intranasal antrotomy was made, the lateral wall of the nose being taken down to the level of the floor of the nose. Then an anterior and posterior horizontal incision was made in that portion of the cyst wall forming the floor of the nose (which portion had been left) and an attempt was made to displace this wall downward to form a flap to cover the hole in the hard palate. This was packed into place with cellulose acetate gauze, after first freshening the edges of the fistula. It was hoped the two raw surfaces would heal together and close the fistulous opening (see diagrams).

Pathologist's report was as follows: "Specimen consists of several irregular masses of fibrous and cartilaginous-like tissue resected from the antrum. Examination reveals a proliferation of fibrous tissue, which in most areas is loosely arranged and which is diffusely infiltrated by small round cells and many plasma cells. Diagnosis: Plasma cell granuloma."

The wound was irrigated weekly postoperatively. One month later, the discharge had ceased and the antrum remained clear. About half of the fistulous opening closed by the above procedure, but the patient still had his cleft palate voice. He returned to college.

On April 24, 1947, the wound was clean, and the hole in the soft palate was closed by the usual procedure for a cleft palate, as follows:

A curved incision was made through the mucoperiostium, about one-fourth of an inch inside the gum margin, paralleling the gum margin and extending on each side from a point a little anterior and lateral to the foramen cecum, posteriorly to a point about one-half inch anterior to the beginning of the soft palate. The mucoperiostium was elevated off the hard palate, medially to the fistulous opening. The edges of the fistula could then be readily approximated without tension, and were drawn together by three mattress sutures after first paring away the edges of the fistula.

An uneventful postoperative recovery was experienced, with complete closure of the palate and a clean antrum.

SUMMARY.

1. A classification is given of cysts involving the antrum, arising from both the antral mucosa, and from the jaws and teeth. For purposes of differential diagnosis, the classification also includes those conditions which may appear radiologically or clinically as cysts and yet are not cysts.

2. The difference between dentigerous (follicular) and ra-

dicular (root cyst) is stressed, and the method of development of each is given.

3. The treatment of such cysts, large enough to involve the antrum, should (in the writer's opinion) consist of a radical antrum operation with a large intranasal antrotomy, and complete removal of the cyst wall via this exposure, except in those localities where palpation may show that complete removal would create a fistula.

4. A case of dentigerous cyst and a case of radicular cyst are cited. In the treatment of the latter, a method of closing a fistula into the palate is given.

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10 South Broadway.

GABRIELLO FALLOPIUS.*

Circa 1523-1562.

His Contribution to the Anatomy of the Nose, Throat and Ear, and His Invention and Use of the Nasal Snare.

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Essex, N. Y.

To Arturo Castiglioni,[1] recently Professor of Medical History at Yale University, and to Guiseppe Favaro, Professor of Anatomy at Modena, Italy, we are indebted for the details and facets of the life and character of Gabriello Fallopius.

He was born in Modena in 1523. From early youth he was interested in anatomy. When he was 21 years old, and as yet had not entered the medical school, he received permission to dissect the corpse of a female criminal who had been hanged. This was in 1544. He entered the medical school at Ferraro the next year.

Permission to dissect the human body, 400 years ago, was not granted promiscuously, and Fallopius certainly must have had influential friends in order that he could do this; he also must have had a great desire to learn anatomy.

It was Leonardo da Vinci[2] who said, "And if you have love for such matter, you will perhaps be impeded by the stomach, and if that does not impede you, you will perhaps be impeded by the fear of living in the night hours in company of such quartered and flayed corpses, fearful to look at, and if this does not impeded you, you will perhaps lack good draughtsmanship, which belongs to such demonstration, and, if you have the draughtsmanship it will not be accomplished by the perspective, and if it is accomplished, you will lack the order of the geometrical demonstrations and the order of the calculation of the forces and power of the muscles; and, perhaps

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you will lack patience, so that you will not be diligent. As to whether all these things have been in me or not, the 100 and 20 books composed by me will furnish the sentence Yes or No, in which I have not been impeded by avarice or negligence, but only by time. Vale!"

Fig. 1.[8] This portrait is a copy of the oil panting that hangs in the Anatomical Institute of the University of Modena. It depicts him to be a rather dour individual, with a high forehead, intelligent eyes, straight nose, heavily bearded, and garbed in the cap and cloak of a teacher. The necessary dignity of a professor had to be concealed behind a heavy beard and dolorous countenance, for the age was indeed a frivolous one and the Inquisition was just around the corner.

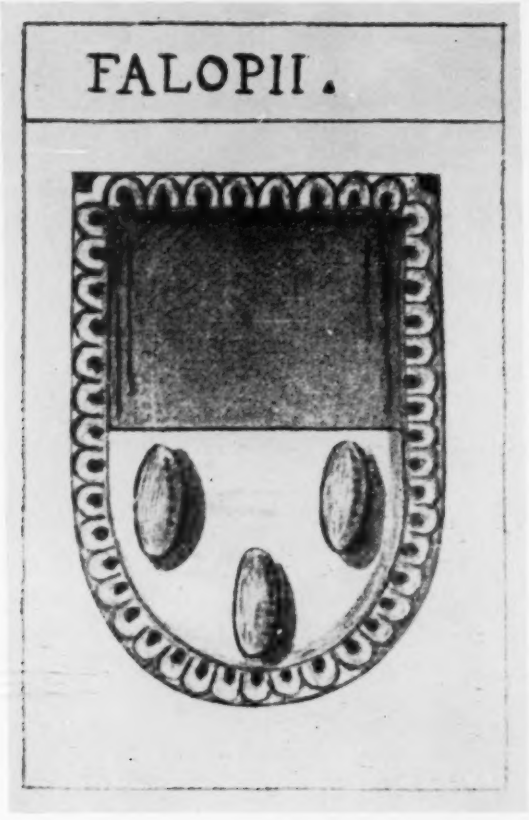


Fig. 2.[8] Coat of arms of the family of Fallopius, registered in the archives of the city of Modena. In the lower part of the chield is shown the three fallope and which is a term for a silk cocoon, not perfected by the silkworm.. in common language it means a mistake or failure. The origin of the name is thus illustrated. Silk was brought to Constantinople in 550 A.D. The cultivation and manufacture of silk spread to Italy and particularly to such towns as Venice, Florence, Genoa and Milan. All of them became famous for their silk textures as early as the thirteenth century.

It is difficult to conjecture why a family coat of arms should display an insignia of failure. Failures in silk culture, religion, finances or politics may suggest themselves; but it still remains obscure and difficult to understand the psychology of such an ancestor in thus displaying his failures and transmitting the knowledge of them to his posterity.

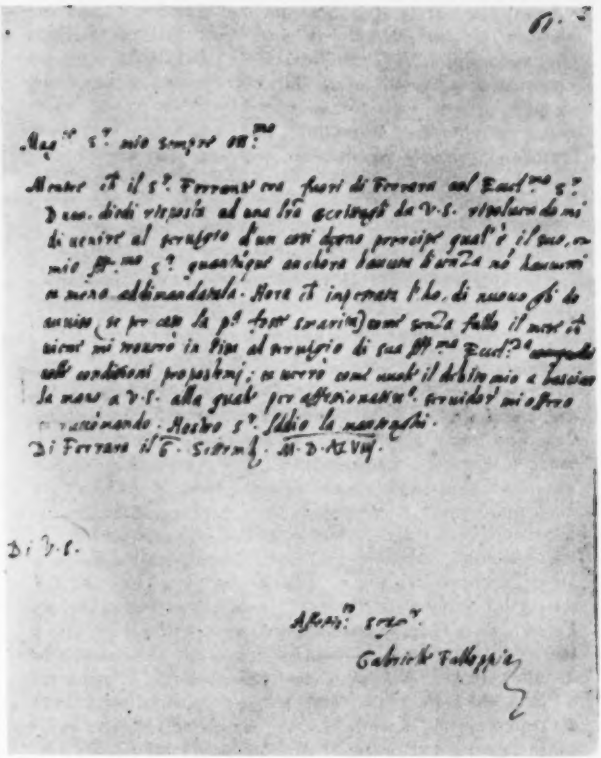


Fig. 3.

Your[s] Excellency always affectionately mine:

While Mr. Ferrano was away from Ferrara with his excellency the Duke; I answered a letter written to him by your excellency. I then resolved myself to come into the service of such a dignified prince anytime your affectionate excellency so desired. Since I still had permission to accept your proposal I did not bother to ask. Now that you ask me once more, (in case my first letter was lost) without fail next month I will be in Pisa in the service of your affectionate excellency under the conditions proposed to me. I will come, as it is my wish to kiss the hand of your excellency. Your servant, through his affection recommends that our Lord keep your excellency in good health.

Your Affectionate servant
Gabrielle Falloppia

Ferrara, 6 Sept., 1548.

This letter is one addressed to Cosimo I, Duke of Florence dei Medici, who called him to teach anatomy at the University of Pisa. He was reluctant to leave Ferrara, but this was the Duke of Florence who was considered as the incarnation of Machiavelli's Prince. It would seem from the tenor of his letter than he understood the inherent capabilities of the Duke. He stayed in Pisa until 1551, when he was appointed professor of anatomy, surgery and botany at the University of Padua.

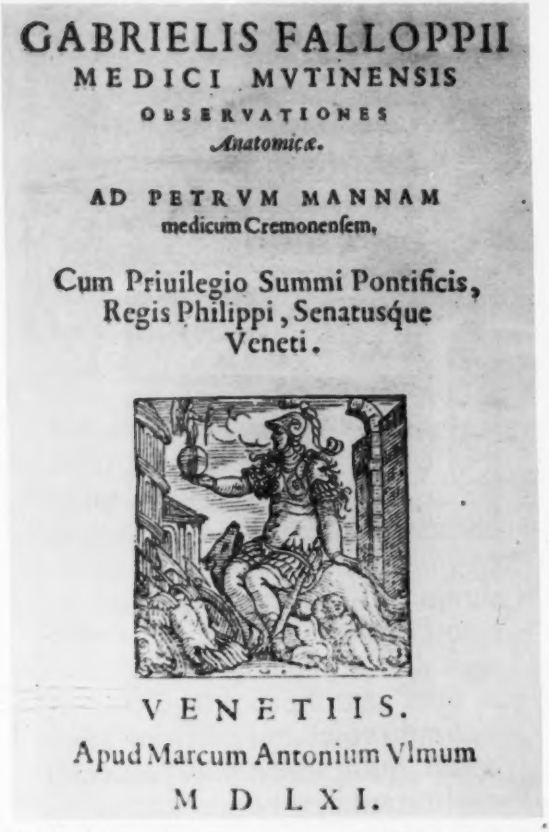
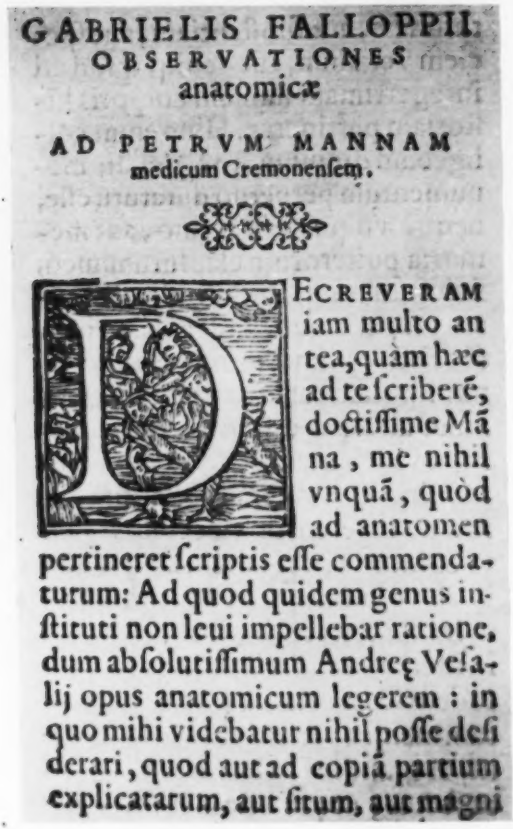


Fig. 4.[3] This is the title page of "Anatomical Observations" of Gabrielis Falloppi, Physician of Modena to Petrum Mannam, Physician of Cremona, with permission of the Supreme Pontiff, King Phillip, and the Senate of Venice, Venice. Marcum Anatomium Ulmum 1561.

This book was the only one published during the lifetime of Fallopius. It stimulated Vesalius to write "Anatomicarium Gabrielis Falloppi Observationum Examen" and published in 1564 in Venice. Unfortunately Fallopius died in 1562 and never saw this critique by Vesalius of his book.

This Printer's Device on the title page shows Mars seated on the Roman wolf. Romulus and Remus are shown. In Mars' right hand he is holding a globe of the world with lines of latitude and longitude marked on it and surmounted by an angel holding an olive branch. Even in those days Peace was a paramount thought.



GABRIELIS FALLOPPII
OBSERVATIONES
anatomicæ

AD PETRVM MANNAM
medicum Cremonenſem.

DECREVERAM iam multo antea, quàm hæc ad te ſcribere, doctiſſime Mãna, me nihil vnquã, quòd ad anatomen pertineret ſcriptis eſſe commendaturum: Ad quod quidem genus inſtituti non leui impellebar ratione, dum abſolutiſſimum Andreę Veſalij opus anatomicum legerem: in quo mihi videbatur nihil poſſe deſiderari, quod aut ad copiã partium explicatarum, aut ſitum, aut magni

Fig. 5.[a] This is the preface to the "Anatomical Observations" of Gabrielis Falloppi, to Petrus Mannam, Physician of Cremona.

"Long before writing these observations to you, most learned Mannam, I determined that I never would commit to the press anything concerning an anatomical subject.

"This resolution of mine was caused to no small extent by my reading of that extraordinarily complete anatomical treatise of Andreas Vesalius in which, it seemed to me, nothing pertaining to a thoroughly adequate account of anything concerning the number, the measure, or the consistence . . . (could be desired)."

ANDREAE
VESALII,
ANATOMICARVM
GABRIELIS FALLOPPII
OBSERVATIONVM
EXAMEN.

CVM PRIVILEGIO.

VENETIIS,
Apud Franciſcum de Franciſcis, Senenſem.
M D LXIIII.

Fig. 6.[2] Comment by Andreas Vesalius on the "Anatomical Observations" of Gabrielis Falloppi, with permission, Venice. Franciscum de Franciscis of Sienna, 1564.

Signature is that of Caspar Bahin 1577, Padua. The Printer's Device shows Ceres steadying a cornucopia with one hand and another holding an olive branch. Peace.

In the first pages of this book the printer explains as follows: "Before Andreas Vesalius recently left here for Jerusalem, he was greeted in my bookshop by Augustinus Gadaldinus, Andrea Marinus, and some other promient physicians who had met there by chance. They asked him particularly whether anything had been done about his 'Anatomicarum Gabrielis Falloppi Observationum Examen'; for he had told them that, as he had been informed by Alexandrus Baranzonus, it had been given to some Venetian ambassador, who would see that it reached Padua. Vesalius said that his 'Examen' had, in fact, been given to that outstanding ornament of the Venetian Senate, the most renowned Paulus Teupulus (Tiepolo) when he left the court of King Philip. However, because of the civil wars in France and also because of the lack of a trireme, Teupulus was compelled to remain in Catalonia for many months and to come here later than he intended; but during this time, Fallopius (as they knew) had died."

Vesalius was big enough to disclaim the priority of having discovered the stapes and states that its discoverer was Ingrassius.

"Thus I have now come to the end of your observations, which have brought me more than a little pleasure and the delightful and jovous memory of that very pleasant life which was mine while I was working on anatomy in Italy, the true nurse of genius." This translation was done by Professor Castiglioni, see reference 1, pp. 190, 193.

After having spent some time as a Canon in the Cathedral at Modena, he enrolled as a student at Ferraro and later became a teacher there and at Pisa and Padua.

In some of the notes appearing in the Encyclopedia Britannica, 1944, volume 9, p. 56, it is stated that he was a student of Vesalius.

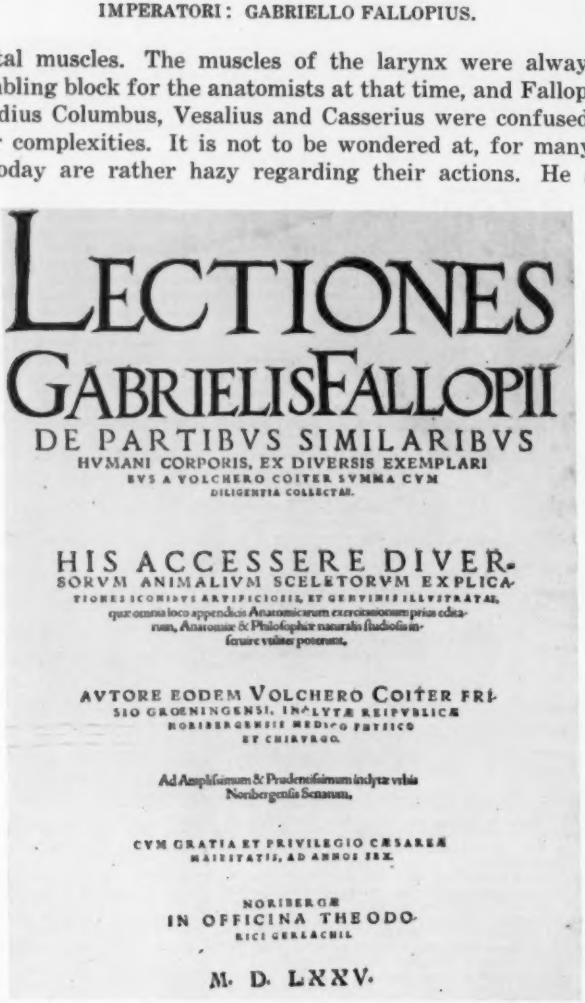
"The[1] supposition that Fallopius had been a pupil of Vesalius is not correct. He had come to Ferrara in 1545 and to Padua later, in any case after Vesalius had left Italy. He clearly stated that he was a pupil of Vesalius in the same sense that Vesalius was a disciple of Galen, 'not in the schools listening to his voice, but in the library . . . having read his writings diligently and having given them thorough consideration'."

The one book that he wrote and that is unquestionably his is the "Observationes Anatomicae,"[2] published in Venice in 1561 by Ulmus and dedicated to Petrus Manna in Cremona, a physician to Francesco Sforza II, Duke of Milan. The authenticity of this volume is definitely vouched for by Volcher Coiter in his edited "Lexonies de Partbius Similaribus." This was published in 1675 by T. Gerlach in Nuremberg.

His[1] description of the canal in the petrosa from the internal auditory meatus to the stylomastoid foramen and its contents, the facial nerve, and the facial canal or aqueductus Fallopius are some examples. His description of the opening on the anterior surface of the petrosa, which is termed the Fallopian histus, gives exit to the great superficial petrosa nerve. He also described and named the chorda tympani, the trigeminal nerve, the auditory and the glossopharyngeal nerve. He separated the glossopharyngeal from the spinal excessory and showed that they were independent structures; he also described the ethmoid bone, and with more detail than Vesalius, the lacrimal bone and also the lacrimal duct.

He described the hyoepiglottic muscle, but he stated that he could find it only in the ox and not in man. In this he disagreed with Vesalius. He also described the pharyngeal and

palatal muscles. The muscles of the larynx were always a stumbling block for the anatomists at that time, and Fallopius, Realdius Columbus, Vesalius and Casserius were confused by their complexities. It is not to be wondered at, for many of us today are rather hazy regarding their actions. He also


LECTIONES
GABRIELIS FALLOPII
DE PARTIBVS SIMILARIBVS
HVMANI CORPORIS, EX DIVERSIS EXEMPLARI
BVS A VOLCHERO COITER SVMMA CVM
DILIGENTIA COLLECTAE.

HIS ACCESSERE DIVER-
SORVM ANIMALIVM SCELETORVM EXPLICA-
TIONES ICONIBVS ARTIFICIOSIS, ET GENVINIS ILLVSTRATAE,
quæ omnia loco appendicis Anatomicarum exercitationum prius edita-
rum, Anatomiæ & Philosophiæ naturalis studiosis in-
seruire valitura poterunt.

AVTORE EODEM VOLCHERO COITER FRI-
SIO GRONINGENSI, INCLYTÆ REIPVBLICÆ
NORIBERGENSIS MEDICO PHYSICO
ET CHIRVRGO.

Ad Amplissimum & Prudentissimum inclytæ vrbis
Noribergensis Senatum.

CVM GRATIA ET PRIVILEGIO CÆSAREÆ
MAIESTATIS, AD ANNOS SEX.

NORIBERGÆ
IN OFFICINA THEODO-
RICI GERLACHII.

M. D. LXXV.

Fig. 7.[1] Lectures of Gabrielis Falloppi concerning parts of the human body collected diligently from different sources by Volchero Coiter. To this is added explanations of the skeletons of different animals, illustrated with artistic and genuine pictures . . . which can usefully serve students of anatomy and natural philosophy. By the same author Volchero Coiter of Groningen, Frisia, physician and surgeon of the famous Republic of Nuremberg. To the greatest and most wise senate of the famous city of Nuremberg. With thanks and royal privilege for six years Nuremberg, in the office of Theodoric Gerlachi, 1575.

DE PARTIBVS SIMILARI-
BVS HVMANI CORPORIS LECTIONES GABRIELIS
FALLOPII MVTINENSIS, EX EIVSDEM AVDITORVM DIVERSORVM SCRIP-
tis collectæ, multis in locis locupletatæ emendatæq; in capita, & me-
liorem ordinem redactæ à Volchero Coiter,

PROOEMIVM.

PARTIVM SIMILARIVM HVMANI COR-
poris cognitionem artis Anatomicæ fundamentũ, & id eo ad scientiam
anatomicam adipiscendam non tantum vtilem, verùm etiam summè
necessariam esse manifestius est, quàm vt demonstratione egeat. Vnde,
cùm meas Anatomicas exercitationes ederem, constitueram tractatum
de similaribus partibus ijs attexere: at nouum concinnare, postquam
Fallopius multoties in schola Patauina de his partibus optimè & eruditè
multis lectionibus docuerit, & cum hæ lectiones à multis olim ipsius discipulis excepræ ad-
huc extare scirem, præter rem fore duxi. Propterea editionẽ de his partibus ad id tempus,
quo earum lectionum mihi fieret copia, distuli. Interea præstanti eruditione & Medicandi
peritia clarissimus vir, Doctor Ioachimus Camerarius Noribergensium eximius Medicus mei
amantissimus & studiosissimus, & D. Georgius Maior in schola Marpurgensi Medicinæ
primarius professor, & Illustriss: Comitis prouinciæ Hassiæ protomedicus, qui diuerso tem-
pore Fallopij lectiones de partibus similaribus exceperunt, mihi scripta sua communicarunt,
Itaq; industria & singulari horum præstantissimorum virorum in excolenda Hippo-
cratica Medicina studio adiutus, mea scripta emendaui, auxi, ea meliora fecis-
gere, ea methodo breuiore tractare, & id, quod desiderari
mihi visum fuit, supplere, pro tenuitate virium
studium,

A 3 CAPVT

Fig. 8.[4] This is the preface to the lectures of Gabriele Falloppio of Modena on similar parts of the human body, collected from the notes of different pupils of his, made more complete and amended, and put into better order by Volcher Coiter.

"That knowledge of similar parts of the human body is fundamental to the art of anatomy, and not only useful in acquiring the science of anatomy but also of the greatest necessity, is too obvious to point out. Thus when I composed my anatomical exercises I prepared to add to them a tract on similar parts: and to arrange something new, for Fallopius often in the school at Padua taught lectures on these parts very well and with great erudition, and since I knew that these lectures were up to then only known to his own pupils, I considered that they should go beyond that. Therefore I published at that time an edition concerning these parts which seemed to me copious. Meanwhile with surpassing erudition and medical knowledge the very famous men, Dr. Joachim Camerarius of Nuremberg, my distinguished physician, most beloved and most assiduous, and Dr. Georg Maior, first professor in the school of medicine at Marburg and physician in chief to the illustrious Count of Hesse, who at a different time heard Falloppio's lectures on the similar parts, communicated their writings to me. And thus supported by the industry and remarkable study of these outstanding men in improving Hippocratic medicine, I have amended my writing, enlarged them, made a better selection of material, treated it methodically and briefly, added what seemed to me desirable and strove according to my ability."[5]

described the Fallopian muscle (pyramidalis), Fallopian ligament (round ligament), Fallopian valve (ileocecal valve) and the Fallopian tube (oviduct).

In describing the sphenoid sinus he says,[5] "There is no cavity in children until they arrive at maturity. It begins to form after the first year. Those cavities contained in the frontal and cheek bones are not to be found in the newborn." He criticized some erroneous opinions held by anatomists of that day regarding the function of the sphenoid sinus. He says, "The third opinion is that they serve for holding the air before it enters the brain. This, while a more respectable opinion, becomes ridiculous in view of their absence in infancy."

After Andreas Vesalius left Padua, it was Fallopius who restored the fame of the Anatomical School at that University; however, with candid modesty he disagrees with some of Vesalius' observations, as shown in the preface, "Observationes Anatomicae."

Modesty certainly was one of his attributes, for in that day to disagree or criticize another usually was accompanied by vituperative remarks and expressions, the mildest of which would be "ignarus discipulus."

He[1] was generous in his observations on Vesalius' great work "De Fabrica," calling him "the prince of anatomists, an admirable physician and a divine teacher."

In his discussion with Vesalius regarding the discovery of the ossicles of the ear, it is with clarity and honesty that he gives his version.

"These[3] (ossicles) were unknown to the ancient anatomists (if we can trust their writings), and the first to discover them was Jacobus Carpensis (Berengarius), who beyond all doubt was also the first to reinstate the anatomical art which Vesalius later perfected. In the "Isagoge Anatomica" and in the extensive commentaries on the anatomy of Mundinus, Carpensis made clear mention of the two ossicles. The divine Vesalius later elaborated this account and described them both very accurately; he called the one which comes first the malleolus

and the other the incus, from their similarity to these objects. The third ossicle (if we are unwilling to defraud anyone of due praise) was discovered by Joannes Philippus ab Ingrassia, a Sicilian philosopher and a very learned physician, while he was publicly teaching anatomy in the Neapolitan school and was engaged in both theoretical and practical medicine (as they say). It is evident from his published writings that this man is so skilled in all branches of our art that he can justly be considered and called a most consummate physician, as indeed he is.

"This is the way in which the third ossicle later became known: In the year of our Lord 1548, when I first began to practice at Pisa, no mention of this bone had been made either by Vesalius, who had taught anatomy at Pisa long before, or by Columbus, your fellow citizen, who had taught the same subject there in the preceding year. At the time when I was engaged in this work, there came to me a certain student of mine, a very learned young man who (if I remember rightly) had received his doctor's degree with honors and was very distinguished, and who was related by marriage to Ingrassia (I absolutely cannot recall his name now). He advised me that Joannes Philippus had discovered a third ossicle in the tympanum and because of its form, had given it the name of stapes. Incited by this to a more zealous application, I was happy to discover this ossicle and I immediately proclaimed it publicly to everybody, to their great admiration. Furthermore, I told about it in a letter to Bartholomaeus Madius of sacred memory, a most learned and celebrated physician, and also wrote about it to certain friends in Rome. They wrote back that they had not heard anything about it from Columbus, who had lectured on anatomy a short while before, nor from anyone else; for aside from those mentioned previously, at that time in Italy there was no one else capable of teaching anatomy skillfully, with the single exception of Joannes Baptista Cannanus (*sic*), a most celebrated physician and anatomist. This is the true account of the way in which the discovery was made known. And although I sometimes have said that this discovery was my own, and others have asserted

that it was theirs, nevertheless the glorious God knows that the discoverer was Ingrassia."

Since the dawn of recorded history, someone was rewarding another for the relief of pain or suffering. Edward Meyer[5] in his "Geschichte des Alten Aegyptens II," p. 95, translates some of the inscription relating to the physician in such a manner that it appears the King had ordered it to be engraved as a testimony of gratitude to his doctor because he had "made his nostrils well." He wishes him, therefore, long life and happiness.

This tablet had formerly been set up in the King's palace in an anteroom where all might see and read it. This slab is said to date back to 3500 B.C. On the slab is the delineation of a physician and his wife with her hand resting affectionately on his shoulder. He was the medical attendant of King Sahura who flourished in the fifth dynasty. His name was Sekhet'enanch, but what the name of his wife was does not appear. It is said to have been everywhere erased from the tablets. What subsequent domestic infelicity this may hint at does not appear.

Nasal diseases have been recorded in the "Papyrus Ebers" and quoted by Wright. Mysterious invocations, gruesome and disgusting prescriptions occupy a prominent place in all records of primitive medicine. Recall the dark cave in Macbeth where the witches' prescription is compounded:

> "Fillet of a fenny snake
> In the cauldron boil and bake;
> Eye of newt and toe of frog,
> Wool of bat and tongue of dog,
> Adder's fork and blind worm's sting,
> Lizard leg and owlet's wing."

Cato the Censor[6] advised, "If there is a wart inside the nose, place dry powder made of wild cabbage in the hand, bring it near the nose and snuff the air up as strongly as you can. In three days the wart will fall out but nevertheless, after it has fallen out keep up the same treatment for some days in order to cure the roots on the wart completely."

Hippocrates[5] practiced the sponge method in the removal of nasal polypi. This was even the method practiced by Vottolini and mentioned in his textbook "Die Krankheiten der Nase," 1890. The sponge method consists in tying several small sponges on a string and with a lead probe pushing the string into the nasopharynx and by traction, and if successful, dragging the polyp with them by way of the nasopharynx. This method was in use when the growth was somewhat loose in the nares. The patient indicated that it felt loose on breathing.

Another method was that of tying a loop of a sinew around the polyp and then carrying the other end into the pharynx and by traction evulsing the polyp or growth. Frequently no sponges were used, but large knots in the string and by a sawing, dislodged some of the growth. The other method was by cauterizing through a tube, the tissue being protected by the tube. Fabricius devised a curved and straight forceps for removal of polyps.

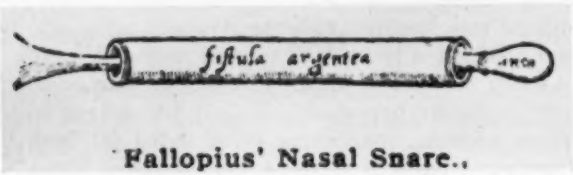
"We have seen the skillful procedures of Hippocrates. We have seen the barbarous modifications of them by Paulus and the Arabians with their knotted strings and little saws. Velpeau, who gives a very much fuller account of the ancient history of this subject than I can find room for here, refers to a procedure I have not elsewhere met with in my reading. He says that William of Salicet proposed the gradual dilatation of the anterior openings of the nostrils with a sponge, or some other device, to render avulsion of nasal polypi easier of execution. The knotted strings of horse hair and of silk were soon abandoned after the Renaissance, and in 1571, Aranzi or Arantius, in giving an account of his method of dealing with nasal polypi, describes not only a forceps with long jaws he had invented for the purpose, but he gives still more interesting details of his way of illuminating the anterior nares. He speaks of the difficulty of blood obstructing the view in the use of the knife, and to obviate this he constructed his long forceps. He obtained illumination by placing the patient in a darkened room and making a hole through a wooden shuter

to admit the ray of light, which was to fall directly into the nasal cavity, which he rendered more patent by raising the end of the nose. On cloudy days he used artificial light, magnified by a water bottle.

Remembering that in the sixteenth century not only were the Greek medical works more faithfully translated into Latin, but that they were more widely read in the original, we may easily conjecture that Fallopius drew his idea of the wire snare for nasal polypi from the works of Hippocrates, but it differed very much from the devices the latter employed; and it is in very fact the modern nasal snare of Jarvis, without the wheel, of which all others at present in use are modifications. By Fallopius' reference to nasal hemorrhoids we also perceive he was familiar with the Arabian pathology, but he makes a distinction between them and ordinary polypi, practically much as we now do more exactly. The hemorrhoids were our vascular hypertrophies, and the polypi were our edematous growths, the former being noted far back in the nose (posterior parts of the inferior turbinated bones?), and the latter being situated in more accessible regions, as a rule. For the cure of the anterior growths he used the ligature, leaving it around the growth for two or three days, when it would fall off with the constricted mass. This method he did not apply to hemorrhoids or "carunculae" in the back part of the nose. He says: "But when the polypus is well within the nose it is difficult to use the ligature, which should encircle the roots of the polyp." He mentions the forceps operation of Paulus and continues: "But I take a silver tube which is neither too broad nor too narrow, and then a brass or steel wire, sufficiently thick, preferably the iron wire from which harpsichords are made. This doubled, I place in the tube, so that from this wire a loop is made at one end of the tube, by which, used in the nares, I remove the polyp. When the polyp is engaged in the loop, I push the tube to the root of the polyp, and then pull on the metal threads sticking out at the lower part of the tube, and thus I constrict the roots of the polyp and extract it, since by this wire loop the root of the polyp is cut because it is a soft substance." Harder growths he pulled

down so that he could cut off the roots with a knife.

Fallopius praised his instrument as very efficacious, and he used it also for polypi of the rectum. He condemns strongly the use of a cautery through a speculum, regarding the practice as dangerous. He also speaks of the string sawing method, which he had never used. His is the first improvement on the method of Hippocrates in removing nasal polypi. The description of his snare was not published for many years after his death. Rhinologists cannot fail to be struck with the appearance, at such an early date, of what is practically a modern instrument.



Fallopius' Nasal Snare.

Fig. 9. Regarding the illustration of the snare in Wright's book, there is no evidence of any such illustration in any of the works of Fallopius. As a matter of fact, there are no illustrations in any of the writings or collected notes of Fallopius. Careful search was made in the volume "Obervationes Anatomicae" 1561,[16] "De Tumoribus Praeter Naturam" 1573, the volume published after his death, and in the "Lectiones" by Coiter, 1575. Where Wright observed this illustration, no mention is made.

When speaking of Fallopius (1523-1562) the names of Vesalius (1515-1564) and Eustachius (1510-1564) can hardly be omitted, for they were contemporaries, but there is no record of any of them having met each other.

"The effective, moving vitalizing work of the world is done between the ages of 25 and 40." So spoke Sir William Osler.

Fallopius died at the age 39, probably of tuberculosis. In his latter years he was frequently absent from his classes, undoubtedly during bouts of temperature, pleuritic pains and asthenia.

Fallopius, Vesalius and Eustachius[7] should be considered an immortal triad, whose life work was of such force that they

reformed the study of anatomy into factual and accurate channels by repeated dissections. The previous anatomical descriptions and the few illustrations, when compared, revealed in most instances, gross inaccuracies. The acme of their fame, Vesalius and Eustachius, culminated in their ability to preserve their dissections and studies by illustrations in wood cuts and copper engravings. There are no records of any anatomical illustrations by Fallopius.

When one considers the many and, at times, the almost insurmountable difficulties imposed on teachers and students of anatomy of 400 years ago, the marvel is — how well they accomplished what must be considered, even today, as masterpieces of illustration and fundamentally accurate anatomical descriptions.

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BOOK REVIEW.

Kurze Klinik der Ohren-, Nasen- und Halskrankheiten. von Dr. Erhard Luscher, ordentlicher Professor und Direktor der Universitatsklinik und Poliklinik fur Ohren-Nasen und Halskranke in Basel. With 201 illustrations in text. Five hundred eleven pages with Index. Basel: Benno Schwabe and Co., Verlag, Klosterberg 27. American agents: Grune and Stratton, Inc., New York. Price 54 Sw. Frcs.

This book is designed for student and medical practitioners. It has been divided into three parts, a review of anatomy and physiology of the field of ear, nose and throat, a description of methods used in routine examination, and a larger section in which the diseases of the ear, the nose and paranasal sinuses, the throat and the larynx are each discussed.

The sections on anatomy and physiology and method of examination are briefly but clearly presented.

The section on ear diseases focuses attention on the underlying pathologic processes and the more essential diagnostic features. The manner of presentation is clear and concise. Discussion of treatment is limited mainly to the principles involved, omitting operative and such technical procedures as may require the technical training of the specialist.

In sections on the nose, paranasal sinuses, throat and larynx, the discussion is concentrated on such conditions as come under the care of the general practitioner. Pathologic processes are described and principles of treatment outlined. Indications for the attention of the specialist as well as danger signs are pointed out. Those conditions which fall into more or less specialized fields such as management of allergy, plastic reconstruction, endoscopy and operative procedures are only briefly outlined.

The general manner of presentation indicates a clear and comprehensive grasp of basic principles as well as wide clinical experience. Nonessential discussion has been reduced to a minimum, yet pertinent information supplied. The book is to be highly recommended for students.

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